

JUNE

1954

AMAZING STORIES



Scientifiction
Stories by

A. Hyatt Verrill

John W. Campbell, Jr.

Edmond Hamilton



WILLIAM HEAVY'S TERRIBLEST OF AMAZING
FANTASIES: HIS IMMORTALITY

AMAZING STORIES

June, 1930
Vol. 5, No. 3

Experimentor Publications, Inc.
E. A. Mearns, Pres. H. E. Fry, Vice Pres. and Treas.

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This month depicts a scene from the story entitled, "The Non-Gravitational Vortex" by A. Elbert Verill, in which the Loch Lomond is shown lifted clear out of the water by a strange force, when the reader studies the pages of the issue in which the strange experimental work is their work.

AMAZING STORIES MONTHLY is published at 10000 Canyon Avenue, Los Angeles, Cal. Entered as second-class matter in December, 1929, under no. 211, Section 1103, Title 39, Post Office Department, Washington, D. C. Post Office at Los Angeles, California. Printed by E. A. Mearns, Experimentor Press, 10000 Canyon Avenue, Los Angeles, Cal. Second-class postage paid at Los Angeles, Cal. and at additional mailing offices. Postmaster: Please send address changes in advance. Second-class postage paid at Los Angeles, Cal. and at additional mailing offices. Postmaster: Please send address changes in advance.



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AMAZING STORIES

THE MAGAZINE OF SCIENTIFICATION

T. O'CONNOR SLOANE, Ph.D., *Editor*MIRIAM BOURNE, *Managing Editor*WILBUR C. WHITEHEAD, *Literary Editor*C. A. BRANDT, *Literary Editor*

Editorial and General Offices: 320 Fourth Avenue, New York, N. Y.

Extravagant Fiction Today Cold Fact Tomorrow

Gas

By T. O'Connor Sloane, Ph.D.

MANKIND has its death wishes for existing uses and more power to the world apparatus. The requirements of manufacturing, building and traveling constantly appeal for larger use of power. In a general way we may classify matter under three principal divisions: solid, liquid, and gaseous. The first, of course, we know is rigid, requires force to break it or to bend it out of shape. It seems to present itself as the best material for accelerating force and developing power. Solid matter used in the air and in machines is generally reliable, and of all the materials, those with the iron base are the most used. But there is very little use in the world and when the iron comes are exhausted, it is hard to say what will be done. But fortunately, in spite of all the machinery we see about us, the total amount of iron used is very little, comparatively speaking. If man were dependent on iron as much for his source of power, he would very soon exhaust the supply. But of the three states of matter to be used for the development of power and the increase of force and pressure often of enormous amount, certainly enough man has to utilize the invisible, light and various gaseous form of matter.

This form of matter is without tensile strength, and is almost indefinitely compressible. We live in an atmosphere of gas, for air is a mixture of gases and seems the least likely thing imaginable as an instrument for exerting power or force. It is really curious to follow out what this light invisible gaseous thing does under proper conditions.

Going back some two thousand years, we are told that Hero of Alexandria devised the first steam engine. His boiler was mounted so that it could turn and when heat was applied and steam pressure produced, one or more jets issuing from the boiler prevented steam to escape responsibly, so that the whole thing, boiler and all, whirled around as a great toy. So we say that mankind long ago grasped the idea that a light invisible gas could be made to develop power. For steam is a true gas, it is a little over half as heavy as air and is just as movable.

To grasp projectiles for landing or for war, the muscular strength of man was first used in throwing the javelin, in shooting the arrow from the bow, in projecting slings by hand or by sling, and by throwing clubs and boomerangs. Then when bigger projectiles were thrown as in attacking cities and fortresses, machines were made which could throw large stones in the construction of which mechanical means were employed.

But the art of killing your fellowman and destroying his structures, reached its greatest perfection, when, instead of missiles, instead of mechanical means, gas was used to send projectiles out into space. The bullets of rifle, the shells of cannon, some of which in the World War were thrown a distance of twenty-five miles, rising to a height of twenty-four miles in their flight, are all discharged by gas. Reaching their destination, shells, which may be a foot and a half in diameter, are exploded with the most destructive effects, by the simple expansion of gas within them.

A bomb may be moved or pushed by hand. By giving it a coil we say the wind blows it along. But the action of the wind on a sail is simply the pressure of gas against the sail, for air is a perfect gas. In former days, a sailing vessel that would cross the Atlantic in two weeks, acquired a celebrity for speed. Now

a steamer goes across in about five days, driven by enormous amounts and their power is due partly and simply to the pressure of gas against the pistons of the cylinders or instead the wings or blades of turbines. In turbines we are coming back to a same as almost all of the modern engines. All engines, steam or various, or internal combustion engines, operate simply and simply by the pressure; by pressure of the one kind of element which seems utterly unadapted to produce such force. The pressure used in the steam engine of the various types is due to gas. In the internal combustion engine such as is used in automobiles, the pressure is produced by expanding a mixture of air and gasoline vapor in the cylinder. The explosion takes place with great readiness because of the large quantity of hydrocarbon gas mixed with the air to at least start the explosion, whose heat converts instantly the rest of the gasoline vapor into the form of gas, so that it will burn with such readiness as to constitute an explosion. And here we come to a serious thing.

The explosion of hydrocarbon gases under various conditions, involving of course, the ignition of a mixture of a combustible with air, may be very violent, and may be ignited by mixing a very finely divided combustible powder with air, the fine division of the combustible, giving it a certain appearance due to the pressure wave. We have explosions in flour mills, where the air charged with dust forms an explosive mixture. It is seen and that the Diesel engine, which burns heavy oil, can be driven by dust fuel, so that one might drive a ship across the ocean, using barrels of flour instead of gallons of oil, which is certainly a rather curious suggestion. But the pressure to drive the engine would be that of gas produced by the combustion of the finely divided solid.

Gasoline, whether the old-fashioned black mechanical mixture of carbon, sulphur and the "valuable sulphur" or the modern chemical compound, all depend for their action upon the production of gas. And this invisible light substance, absolutely without strength of any sort, develops power and force which can produce the most terrific effects. It is almost a contradiction of ourselves that such a thing as gas can do what it does in the way of developing the most intense streams and forces known to mankind.

It may seem to be a wild story but gas is used to cut great steel bars and other steel and iron forms. The little gas blowing torches produce heat, but this is not enough to cut steel. But by giving an excess of oxygen to the blowpipe jet an oxidizing flame is produced. When this blowpipe on iron or steel, it burns it fiercely, converting the surface into lighter magnetic oxide, which as fast as produced flows away. Now a liquid, exposing a fresh surface, and more gas is forced through. In this way a channel is cut through the heaviest bars in a few minutes. The blowpipe can even cut steel deep down under water.

In the comparison between the airplane and dirigible, the advantage of the plane may exist in not requiring gas. But it is in the air, which is a gas, which supports them. They are upheld by the pressure of a gas. A partial vacuum is produced on the upper surface of the wing and the unbalanced pressure on the lower surface supports the plane.



Q. . . And now, though it outraged common sense . . . though my mind could not fully grasp the actuality, the impossible had occurred, and we were in the presence of the mysterious, invisible phenomenon.

The Non - Gravitational Vortex

By A. Hyatt Verrill

Author of "The Astonishing Discoveries of Dr. Mentiroso," "Into the Green Prism," etc.

Illustrated by MOREY

WHAT is gravitation? Where does the earth's gravitation cease? Does it end abruptly—as though there were a gravitational wall to shut it in at some certain distance from our earth? In short, what do we know about gravitation? Very little, except its effects; its cause may be defined as the presence of matter. But why does matter produce it? It may be that if ever we find out what it is all about, some effective method for annihilating gravitation may be found. On the other hand, it may be that the secret of gravitation may be discovered only after some annihilating process is found. Mr. Verrill gives us here an extraordinary tale dealing with this theme, in which he tells about vortices that develop a strange phenomenon—the local annihilation of gravitation. And he gives us ingenious suggestions that simulate plausibility and proof.

CHAPTER I

A Dual Personality

THOUGH we may not always realize the fact, men with dual personalities are many. Not necessarily Jekyll and Hyde characters; yet men with two natures as distinct and opposed to each other as were the two sides of the famed Doctor Jekyll. Many a man, counted by those who know him best as miserly and selfish, secretly gives great fortunes to charity. Many a man who pretenses to be an agnostic or even an atheist contributes to missions and builds churches, and many an old miser who spends nights in rhotom living is a staid, dry-as-dust scientist in his home town or among those who know him. Indeed, I truly believe that every man and woman possesses this duality of personalities—that in all of us there is a constant struggle for supremacy between two individualities, and that it is only a matter of degree or per-

haps of self-control, or maybe fear, that differentiates those whose one personality dominates and those whose two personalities have equal play.

Such a man was my old friend Sir Esmé McDonald. To the world at large, to the press, even to the majority of his most intimate friends, and most certainly to his matter-of-fact business associates, Sir Esmé was a millionaire dilettante; a good sportsman, a high-living Scotch laird with thousands of acres of shooting in the Trossachs, a castle near Welling, a fine ocean-going steam yacht on the Clyde, a hunting and a manor-house in the Midlands, and an ugly, curtain-windowed mansion just off Berkeley Square.

A fine figure of a man well over six feet, broad-shouldered, sturdily as one of his own beeches; florid-faced, active, energetic, keen-eyed—Sir Esmé was the best type of Briton; reserved, hospitable, with the easy quiet assurance that only generations of breeding can produce; intense in his ideas and his dislikes, a steadfast friend and, with his intimates, logacious, enthusiastic and unro-

worid. Yet I doubt if among all his friends there were more than a dozen who knew or suspected anything of his other personality. And I am sure that, aside from myself, not three of Sir Esme's most intimate friends—no, not even members of his own family—were aware of the prominent place he occupied in the scientific world; the remarkable discoveries he had made, the innumerable manuscripts and scientific articles he had written, nor that Sir Esme MacDonald, Bart, was identical with Alexander MacDonald, the internationally known scientist.

One might have visited his Scotch castle, his Midlands home, his London residence, and nowhere, from cellars to roofs, have found a trace of any scientific instruments, scientific books or any object that would have led one to suspect that the millionaire, sporting Laird was the least bit interested in anything save shooting, hunting, golf, fishing, horse racing and yachting. The books that filled the shelves of his libraries were the most expensive first editions and editions de luxe; his galleries were hung with priceless paintings by the most famous of old masters and modern artists. There were prints of sporting scenes, wild animal trophies, yachting, polo, racing and hunting cups and ribbons; mounted heads of deer, antelope, wild goats, buffalo, ibex and countless other antlered and horned beasts; stuffed record-breaking salmon, trout and deep-sea fish; there were alliums, pheasants, grouse, capercaillie and other game birds in cases, but never a retort, a telescope, a microscope nor an electrical or chemical device was in evidence.

Yet, tucked away in an old Georgian house off Earl's Court was perhaps the most perfectly equipped physical, chemical and electrical laboratory in the British Empire. The upper story housed three magnificent telescopes with complete astronomical photographic apparatus, celestial charts and every appliance known to modern astronomers—as well as to the ancients—with many that no one, aside from their owner and inventor, had ever seen. And here—when Sir Esme disappeared from his castle, his city home or his business for days or weeks (as he often did) or when he vanished for a night, Alexander MacDonald might be found, working over some new theory, carrying on involved and bewildering experiments in physics or chemistry, or studying the heavens.

Why Sir Esme should have taken me into his confidence, as he took few others, I cannot say with certainty. Possibly it was because, being an American, he felt that my status was different from that of any British friend; perhaps it was because of my extremely liberal views on much mooted scientific questions; or again it may have been because we were mutual friends of Dr. Thomson, who, I believe, shared Sir Esme's secret. But I prefer to think that it was solely because Sir Esme had implicit faith and trust in me and—I say it without egotism—because from the moment we met there sprang up a most intimate and delightful friendship.

If there is anything in the theory of auras or of magnetism between fellow men, then most assuredly Sir Esme's and my auras must have blended perfectly, for never have I taken such an instantaneous liking for any man and, as he himself admitted, Sir Esme took as great and so unaccountable a liking for me. Yet it was a long time after we first met before he revealed the fact that he led a dual life, and that he was, to the scientific world, Alexander MacDonald. Possibly he might never have let me into his secret had we not, during a conversation, touched on a matter on which we both held very near-

thodox views. As it was not a scientific matter and had nothing to do with this story there is no occasion for going into details. Suffice it to say that Sir Esme held very pronounced views in the course of the argument—in which, however, we agreed in many ways—he let slip a hint of a profound scientific knowledge that amazed me. In fact, I expressed my amazement that he, whose interests were so far outside those of scientists, should quote science and should be so familiar with matters usually known only to them. He seemed a bit put out for a moment, flushed, stammered and then with a hearty laugh declared he would astonish me still more, if, on an appointed evening, I would call at a certain house in Earl's Court.

Needless to say, when I was admitted by a sphinx-faced, gray-haired butler and led to a library or study that was radiant of science, I found Sir Esme in person. No, I cannot say in person, for he seemed to have altered his appearance with his personality. No longer was he the bluff, out-of-doors sportsman or the immaculately clad clubman. Instead, I saw a dignified, serious-faced man with slightly sloping shoulders, clad in a deacon smock, with low-toned voice, who appeared far more like a college professor than a hard-riding, hard-shooting Scotch laird.

OF our first evening together, or of many subsequent evenings that we spent in his laboratories or his observatory, there is no need to speak, other than to state that I found the scientist, Alexander MacDonald, one of the most remarkable of men and possessing a most profound knowledge of nearly every branch of science. Astronomy was a hobby, chemistry a lard, physics a means to an end, but his obsession was electro-magnetism, or, to be exact, a force, which he claimed to have discovered, and which had been confused with electro-magnetic force by all other investigators. As he put it, in trying to make his meaning clear to me, the new force bore much the same relation to electro-magnetic force as radium bears to uranium. And according to his theory, as borne out by his exhaustive researches and experiments, this force, which he alone had isolated, was the fundamental force that controlled the universe.

"It is," he declared long after our first meeting, "the force that, since the days of Newton, has been erroneously called gravitation. Scientists for years have been endeavoring to fit Sir Isaac's theory to actual facts or vice versa, but without success. Hundreds—I might even say thousands, of theories have been advanced, yet in every case these theories have failed to explain every condition. All have been wrong, yet in a measure—in some respects—all have been right, for the fact remains that there is such a thing as gravitation. Yet as man has been groping in the dark he has been usefully handicapped, and as is the case in so many branches of science, he has deduced theories to fit his own ideas or assumptions. Why, my dear sir, consider how universal is the belief that the solar system is built up on a basis of the attraction of gravitation; that, should our earth—any of the planets, in fact—move within the so-called radius of the sun's gravitational attraction, we, or they, would be drawn to the sun; that an object projected into space beyond the earth's gravitational 'pull' would fly, let us say, to the moon. Yet can anyone, any scientist, offer a rational common sense explanation of why the various planets remain at their exact and proper distances apart?"

Can anyone give a sane and sensible reason for the heavenly bodies rotating and following their orbits without being 'drawn' together? Can anyone explain why the supposed 'attraction' of our earth remains constant at any height from its surface that man has ever attained?" He laughed. "Where, may we take these theorists, does the earth's 'gravitation' cease? Does it end abruptly—like a gravitational wall—at some certain distance from our earth? Does the man, the object that drops from a balloon or an airplane at twenty thousand feet in air, drop any more slowly? Does he feel less gravitational 'pull' than if he dropped from a height of five hundred or one hundred feet?"

I confess I could find no reply to these queries, but not being an expert in physics and never having given much thought to the phenomenon of gravitation, I could do little more than listen and admit my ignorance as well as my open mind.

But as we became better acquainted, and as Sir Esme, too, Alexander, gained more confidence and found an outlet for his pen-up and restrained scientific ardor in talking with me, I became not only intensely interested but absolutely amazed. And who could avoid being amazed if he should see a lump of lead when tossed in air remain poised midway between floor and ceiling? No, more. If he should actually see the metal move up and down, to right or left at will? And yet precisely that first I witnessed with my own eyes in my friend's laboratory.

"But, good Lord!" I exclaimed, "you've conquered the air. If you can do that you can build an airship that will float anywhere, that can move in any direction, that cannot fall. Why on earth don't you make practical use of your discovery? Why not give it to the world?"

He smiled, and shook his head. "No," he declared, "you are mistaken, and instead of benefiting the world, my discovery, if made public at this time, might result in irreparable damages—perhaps even in the annihilation of mankind. I have not 'conquered the air' as you put it. I have merely discovered the force that controls gravitation. I—"

"But," I objected, "I have always understood that if it were possible to overcome gravitation, to the extent of permitting a body to remain suspended in space, it would only be necessary to let the earth rotate on its axis while the floating object remained stationary in order to travel at a speed of approximately one thousand miles an hour without means of propulsion."

Sir Esme—no, Alexander Macdonald—burst into a peal of laughter. "What tummy-rot!" he cried good naturedly. "In the first place, my friend, the object—let us say the machine—even if relieved of the effect, or partially relieved, of the effect of gravitation, would still be in the earth's atmosphere, and as the atmosphere rotates with the earth, your floating airship would move with the air and would remain poised over the same spot on the earth's surface. And—"

"But suppose it floated in space—above the atmosphere?" I argued.

He winced a bit contemptuously. "Even if that were possible—which it is not, owing to a dozen reasons I could present—your machine would not remain poised and stationary while the earth revolved beneath it. That is, not unless the gravitation was cut off over the entire surface of the earth, in which case everything would fly off and join your floating ship. And that, my friend, is why I say my discovery might prove a curse instead of

a blessing. I can diminish or perhaps better counteract the gravitation, for as a matter of fact the force I have isolated acts from the outer space downward or rather inward instead of from the earth outward as everyone has assumed. I can, I say, manipulate this force to a certain extent, so far as it affects any small body of certain substances, among which is lead. Possibly I can best make my meaning clear by comparing my newly discovered force to a beam of light.

"By means of a convex lens a beam of sunlight may be concentrated upon an object—let us say a bit of lead—so that the metal will melt, yet outside that concentrated beam the sunlight has no such effect upon other bits of lead. In other words, by means of my apparatus I can prevent a ray or a beam of force from acting upon a certain object, although everywhere about it—outside the sphere of effect of my apparatus—the force remains unchanged and objects remain as still. And above a certain distance from the earth's surface my apparatus fails to control the force, just as the lens would fail to concentrate the light beam beyond its proper and established focus."

"Mmm," I mused, "I think I understand; but I saw you move the lead to right and left. Why can't you carry it a bit farther and move it to any extent? And why shouldn't your apparatus be set up in an airship and thus be used to nullify gravitation as it proceeds, even if it were compelled to remain at a fixed distance above the earth?"

Sir Esme smiled condescendingly. "All very well in theory," he said, "but not in practice. The effect of my device is—well, I might say, to create a hole in the gravitational force. If the apparatus were placed at a vessel as you suggest, this 'hole' would extend not only downward towards the earth but upward as well, and the result would be that your ship and its apparatus would remain in static gas; in other words the reversed effect on one side would counteract the effect on the opposite side. In fact, I am not at all sure that the object might not be completely disintegrated; I must try that experiment. No, my dear sir, in order to operate, my device must be placed on the surface of the earth, and even that it must be insulated by means of an alloy I have discovered. And like many inventions and discoveries, this one is only successful on a small scale. I can raise that half pound piece of lead as you see; but I cannot budge a mass weighing ten pounds."

"Why can't you increase the power of your machine in proportion to the weight of the object?" I asked him.

He shook his head. "No use" he declared positively. "I've tried it and it doesn't work. No, the whole thing is in its experimental stage and it's a beastly dangerous thing to experiment with, unless the greatest care is used. If it were made public some enthusiastic ass might succeed in eliminating gravitation over a considerable area. Think of the result in that case!"

"Well it's damned well—downright uncanny," I said, staring at the bit of lead still poised midway between the table and ceiling. "And it seems to me there must be some use—some value to it."

"Eventually perhaps," he agreed, "but it would amaze you and many other laymen if you knew how many astonishing scientific discoveries are made, which are relegated to the limbo of forgotten things, merely because they cannot be put to any useful or valuable purpose. I could name dozens. In fact I have personally made dozens of

such discoveries. But mainly they are made by scientists employed by commercial firms who take no interest in any scientific discovery that fails to fulfill their requirements."

"Yes," I observed, "I suppose that's true. I've heard others say the same thing; but it seems to me this is a really big, an astonishing thing. And you said yourself it upset all existing theories and might revolutionize physics and other sciences?"

He nodded. "Quite so," he agreed. "But—with a sigh—"what use is revelation unless something is gained thereby? However—" he paused and gazed contemplatively at the floating piece of lead—"somehow I have a feeling, a hunch as you Americans would express it, that there is something back of it, that I am on the eve of a great discovery; a great truth that will startle the world."

I laughed.

"I should say that the discovery you have already made is quite startling enough," I told him.

CHAPTER II

Harvey, an Enigma

SIR ESME'S lapses into his scientific personality were very irregular, and often, for weeks at a time, the Earl's Court laboratory was dark and deserted and to all intents and purposes Alexander Macdonald ceased to exist. Again, Sir Esme Macdonald would vanish quite as completely as if the earth had swallowed him up, and for days or weeks he would be lost to the world as he buried himself in his scientific researches. As I never knew when he would be at his laboratory, and as I had no wish to intrude myself upon him, it had been agreed that when he was in the Earl's Court house and wished my companionship, he would notify me. Among his other idiosyncrasies was a detestation of the telephone that amounted almost to a mania. Although for business and other reasons phones were necessary in his home, or rather in his various houses, he never permitted the instruments to be within his sight or hearing and never used them himself.

It was a long time before I learned the reason for this seemingly unreasonable prejudice against telephones, and I was at a total loss to account for such an apparently ridiculous attitude on the part of a man of Sir Esme's character and mentality until a mutual friend explained. Sir Esme's only son, the heir to his fortune and his title, (the Baronet was a widower) had been instantly killed in an airplane accident, and the tragic news had been communicated to him by telephone. The shock was, of course, overwhelming, and I could well understand why, after such a harrowing experience, he could not bear the instruments that were constant reminders of the tragedy, and I could not blame him for his attitude. I mention this fact because it had a rather important bearing on the events that I am about to relate. Owing to this feeling on the part of my friend, it had been arranged that he should communicate with me through his man, Harvey, the old and trusted retainer who had admitted me to the Earl's Court laboratory on the occasion of my first visit to that place.

Harvey was a most remarkable personage, and as he played an important rôle in our adventures, a few words in regard to him are essential.

HE was, I should say, a man of sixty, about Sir Esme's own age, and had been picked up, hauled to a rude raft of wreckage in mid-ocean, by Sir Esme, who was cruising on his yacht. When rescued, the castaway had been unconscious. For days he had hovered on the verge of death, and when he eventually recovered his health and strength, his mind, as far as his past was concerned, was a total blank. He could not recall his own name, the name of the vessel that had gone down, how the accident occurred nor any other detail of the past. In vain Sir Esme and innumerable specialists tried to restore the man's lost memory, to reawaken his mind. To him life began with the hour of his recovery aboard the *Leck Crown*, Sir Esme's ocean-going yacht, a splendid five-masted bark, for Sir Esme was a true sailor and had no use for steam.

But that the man had been at sea or was a seaman was soon evident. He seemed instinctively to know the name and location of every line, sheet, brace and halyard aboard the yacht, he could navigate, and every now and then flashes of past knowledge and experience would come to him, surprising himself as much as others. For example: on one occasion, as the yacht was making a strange port, he cautioned the sailing-master to keep a trifle more to starboard as there was an unmarked rock on the port side of the channel. Another time, when running for shelter under double-reefed topsails in a typhoon, he declared that a safe harbor and secure anchorage lay behind a wooded point.

At times, also, he exhibited a knowledge of matters and of an education that had no place in a seaman or a ship's officer, and that puzzled Sir Esme tremendously. Not that he could converse on such matters nor discuss them intelligently or at length. They were mere flickers, unconscious or perhaps better, subconscious, glimmers of things familiar to him in his former existence; fleeting memories gone almost as soon as they were formed. The naming of some strange bird, beast or plant; a reference to some important date or event of the past, a quotation from some classic or poem, the mention of some person or place, and on one occasion, when Sir Esme was puzzling over an abstruse mathematical problem of astronomy, the factor by which the problem was solved. He was, in fact, a man of mystery, and Sir Esme, as well as Harvey himself (a name he had taken by choice) had devoted days and weeks to searching the lists of crews and passengers on all vessels that had been wrecked or reported missing at the time when he had been picked up. No one who answered Harvey's description had been lost so far as could be determined, and the only vessel that had disappeared with all on board, and of which we complete list of passengers—if she carried any—and crew was obtainable, was the *Santa Inez*, Spanish vessel plying between Vigo and the Canaries and which, by no possibility, could have been within a thousand miles of the spot where Harvey had been found adrift upon his bit of wreckage.

It is almost impossible for a normal man to fully realize what Harvey's condition meant in life. He was like an infant transformed by magic to a fully developed man, like an untamed savage whisked by a miracle into the midst of civilization. Everything, even the commonest everyday matters were, to his mind, absolutely new, although I must qualify that statement somewhat. Though he could recall nothing of his past, though his life and world began—as far as his consciousness went—on the

Leah Lovers, yet certain features of his past remained. He could read and write; he spoke several European languages fluently, and in his educational attainments he was the equal of the average high school boy. But such matters, as well as his knowledge of everyday affairs, food, clothes, behavior, etc., seemed instinctive. So, too, although he could not recall ever having seen them, railway trains, motor cars, all the modernities of our civilization seemed perfectly natural to him. But dates, events, the World War, the most important occurrences prior to his rescue, were absolutely unknown. At first he had been very sensitive in regard to his condition, he had avoided other men—though fairly worshipping Sir Esme—and had consequently developed a taciturnity, a shell of aloofness, of silence and of impassivity that surrounded and enveloped him like a coat of mail. Even to Sir Esme he was inarticulate.

He had insisted from the first upon being Sir Esme's servant, his very shadow. It was hopeless for the Baronet to attempt to dissuade him.

And as he was at a distinct disadvantage among the other servants on Sir Esme's estate or in his various establishments, the Baronet hit upon the plan of taking him into his confidence, installing him as the sole servant in the secret laboratory and making Harvey the valet, butler, caretaker, gas-fitter, assistant and general factotum of Alexander Macdonald.

He felt that with Harvey the secret of his dual personality was safe, and Harvey seemed to accept the anomalous condition of his master as perfectly natural. He never addressed the Baronet or referred to him as Sir Esme or My Lord. Always it was "Sir" or "Mr. Macdonald" or "Mr. Alexander." And to Sir Esme's amazement, Harvey, without any instructions or suggestions, had been perfectly at home among the difficult and complicated scientific devices and apparatus in the laboratory and observatory. As though he had all his life been quite accustomed to such things, he knew the purpose, the use of everything, and when, out of curiosity and as a test, the Baronet—or as I should call him Alexander—gave him permission to make use of the equipment, he discovered to his utter astonishment that the memory-dead man possessed a subconscious and quite inexplicable knowledge of the sciences that was almost equal to his own. The thing was the more amazing as Harvey could not himself give any explanation of why or how he did this, that or the other. To him the word electron meant nothing, yet Esme an extension or a man under hypnotic influence by produced a device by which he secured a photographic record of an electronic flow on a metal disc. When Sir Esme—no, Alexander—mentioned the constellation Arctis, Harvey's face was a blank, yet he readily and unhesitatingly adjusted the telescope to precise position to bring Arctis into the field of vision.

"He is the most amazing person in the world, really!" Sir Esme declared, when he told me of Harvey's history. "He must have been a man of the highest attainments in general science yet, as far as conscious knowledge is concerned, he is ignorant of the very rudiments of science. Do you know, I would really give a great deal if I possessed a knowledge of psychology, so I could devote myself to studying him. It is for all the world as if he were living in a dream—acting, moving, existing on white asleep, yet talking, behaving, living his ordinary life as though wide awake."

But though I believe as you do, for I was not quite

sure of my friend's psychological condition or his knowledge of his own dual personality, Harvey to my mind was no greater mystery than his master. The case presented two distinct personalities, each conscious, while the other possessed two aces the one conscious and the other sub-conscious. For that matter I was not, and even yet am not quite sure of the Baronet was fully conscious of the existence of his two selves. Never, while he was Alexander Macdonald, did he refer to Sir Esme McDonald save as another and wholly distinct individual. Even when he was telling me of Harvey's history he did not speak in the first person, but narrated the story exactly as if telling of some other man's experiences. He did not say "I picked him up at sea." He said, "He was picked up by Sir Esme McDonald." And when my friend was in the rôle of Sir Esme, never did he refer by so much as a word to a hint to Alexander Macdonald, the scientist. So, after all, perhaps of the two men, Sir Esme was the most amazing.

But to go back to where I stated that it had been agreed that Sir Esme—yes, I shall refer to him as Sir Esme—to notify me that he would welcome my company at his laboratory.

It was several weeks after I had witnessed his amazing experiment with the bit of lead when Harvey rang my bell and announced that "Mr. Alexander" wished to see me at the Earl's Court house.

"Very well, Harvey," I said. "Tell him I'll be over in an hour or so. I have an appointment to meet some friends leaving Victoria station at ten. Then I'll go direct to the laboratory."

Harvey hesitated a moment, his sphinx-like face betraying nothing. Then, with a typical butler's cough, "I beg your pardon, sir," he said. "But I would suggest that you should come at once, sir. I—well, sir, to tell the truth, Mr. Alexander seemed greatly excited, sir, and most anxious for you to join him at the earliest possible opportunity, sir. I trust you will not consider me presumptuous, sir, but if you could find it convenient to see my master first, sir, and to keep your appointment here, sir, I would advise it, sir."

Now, never before had Harvey made such a long speech. Never had he offered a suggestion as to my or Sir Esme's actions, and I felt sure that some most important matter indeed must be about to have caused him to speak as he had. So, filled with intense curiosity to learn what had excited my friend and why my presence was so essential, I scrapped all my prearranged plans, stopped only long enough to phone my departing friends that I would be unable to see them off, and with Harvey, hurried to the Earl's Court laboratory.

CHAPTER III

Positive Signs of Success

HARVEY had not exaggerated. Sir Esme was more than excited, in fact for a moment I feared that something serious had happened, that he was ill or deranged. He was wild-eyed, his hair was disheveled, and he was pacing nervously, restlessly, up and down the hallway, puffing furiously at a huge pipe, and muttering, exclaiming to himself. But at my entrance he wheeled. His eyes lit up with pleased recognition. The next instant he was almost forcing me down the hallway and into his library.

"Thank heaven you're here!" he cried. "If I'd been compelled to keep this to myself much longer I would have gone mad. I must tell someone, and you're the only one I could think of, could depend upon, could trust. By God, no one else would believe it! But you—" he laughed harshly—"you're no scientist, so you'll believe. Your mind is open—free of hide-bound prejudice. Yet I can't yet believe it myself. It's too big; it has too many possibilities, and—damn it all, it's too uncanny!"

Each moment he was getting more and more excited. While excitement in some men might seem quite natural, in the case of Sir Eame, the most unemotional, unexcitable man I had ever known, this feverish, nervous excitement seemed almost unthinkable.

"What is it? What's the trouble?" I asked him. He laughed, hoarsely; almost, I might say drunkenly. "I hardly dare tell even you," he declared. "It sounds too preposterous, and when I have told you, and if you believe it, you won't wonder I'm almost mad; in fact I do not blame you in the least if you think I am mad." Then, with a great effort calming himself: "It has to do with that same force," he said. "I've been experimenting, testing, but it was Harvey who gave me the real idea, the real suggestion—Harvey and you, my friend. Really I take no credit whatever for it. I—"

"The old story of fools rushing in, eh?" I laughed. "Not fools," he retorted. "Harvey's no fool and—"

"I am," I interrupted. He chuckled in the old way, and I thanked heaven his unusual excitement had vanished. "Not a bit of it, by Jove!" he declared. "The scientists are the fools. But seriously, do you recall your remarks about my discovery? About objects flying off into space and so on?"

I nodded. "And do you remember that I stated that I could lift an object only a certain distance? That I could lift only objects of definite weights? That my apparatus operated upon or repelled the force for only a certain distance, and over a definite, restricted area?"

Again I assented. "I was the fool," he exclaimed. "But Harvey brought me to my senses. He was watching my experiments and instructed as if to himself 'vortex.' 'What do you mean?' I demanded. Poor Harvey winked his eyes, gulped and seemed to come out of a trance. He didn't even know he'd spoken. Then suddenly, like an inspiration it came to me. Vortex! Whirlpools! Whirlwinds! Like a flash I understood! The force I had discovered, the force that was the real source of gravitation, what repelled by my device acted like a vortex—a whirlpool—but a reversed vortex. Do you understand? Do you see? My instrument represented the apex, the point of the vortex, a disturbance of the force, that spread out like a cone as it ascended, like—well, like any other ray, like the beam thrown by a searchlight. You remember I compared my force to a beam of light when I showed you the floating piece of lead—" he laughed—"but I had no idea, no conception at that time of the existence of my smile. And just as a ray, a beam of light—for that matter just as sound—thus out, becomes weak, in ratio to the square of the length of its radius from its origin, so this force at the apex—the base of the inverted cone of influence—of the interrupted force I created, became thinner, fainter, less powerful in ratio to the square of the distance from its origin and its angle of—well, I might say tops. No wonder my lead rose to a definite height and

remained there. No wonder I could not lift an object exceeding a certain weight. I—"

"Hold on!" I ejaculated. "You're getting too involved for me to follow. I grasp the cone idea, but I don't see why, if you used greater power or force or a larger apparatus or whatever you may call it, the cone or vortex would not be proportionately increased in force and hence a larger weight would be lifted to a greater height."

"Ah, but my dear sir, that was just the trouble," cried Sir Eame. "When I increased my power, as you call it, I merely created a more widely diffused disturbance of the force. It was analogous to using a more powerful light in the searchlight but also using a wider distributing lens. There is greater light to be sure, but it is spread by the lens to a wider angle and throws a beam no farther than the smaller light with the smaller lens."

I SHOOK my head in despair. "Now let me get this straight," I begged him. "One moment you compare your force, no, the area wherein the force is notified, to a vortex or a cone. But the next moment you state that the objects either rise or move away from the apex of the vortex. I thought, in the case of vortices, everything was drawn from the edges into the space."

Sir Eame gazed at me pityingly and I knew he thought me the fool he had once called me to be. But he was very patient, now that he had relieved his pent-up feelings by discussing the matter with me.

"I didn't intend to convey the idea that the affected area—the force vacuum as I might express it, was rotating, whirling like a true vortex," he explained. "I have no reason to assume or to think that there is any such movement taking place. No, the very reverse is the case; the object affected is the moving object. Have you—of course you must have witnessed the feat of a motorcyclist driving at top speed around and around the interior of an inverted, conical track. Or, to put it even more simply, you know that a sharp curve on a road should always be banked. You must be familiar with so-called centrifugal forces, the tendency of a moving object to slide off to one side when traveling in a circle. That is what occurs when I operate my repelling device. The object affected races about the invisible circumference of the inverted cone of force-vacuum and so mounts upward, just as the motorcyclist rises swiftly towards the top of his conical enclosure. But—"

"But—" I interrupted him. "The lead most certainly did not move. It remained stationary. It rose straight up."

"I beg your pardon, but it most assuredly did not," he declared. "To your eyes, to mine it appeared to do so. But the human eye is incapable of registering motion beyond a certain—and very moderate—speed, just as the human ear cannot register sound above or below certain limits of vibratory waves." "You mean to say—" I began, but he checked me with a gesture.

"Recently," he cried. "You cannot see a rifle ball passing through the air. You cannot distinguish the individual spokes of a rapidly moving wheel, yet you must have observed that in motion pictures the spokes of a wheel on a moving motor car often appear to be stationary or to move in the reverse direction. And if a disk or a ball is rotated extremely rapidly no human eye can determine whether it is stationary or is rotating. In this case—"

"Granted that I might not detect its motion if rotating

on its own axis, I naturally would have seen it if it had moved about the circumference of the cone-like area," I argued, "For had it moved about with sufficient speed to have rendered its travel invisible, the object itself would have been invisible."

Sir Esme chuckled. "Your reasoning is remarkable for a non-scientific man," he told me, "but you forget, or perhaps I forgot to state, that the cone of force-vacuum is so small—its diameter so small—that your argument does not hold. The diameter of the cone of affected space is, at the limit reached by the object, precisely that of the object, or at the most, only slightly larger than, the object itself. The moment the object attains to that point it ceases to higher. Consequently, as it rises steadily—probably thousands of times a second—around the circumference of a cone no larger than itself, it practically rotates upon its own axis and hence to our eyes it appears to be stationary. Ah, I know, for I very foolishly touched the piece of lead white poised in air and the thing shot off with centrifugal force with the speed and power of a bullet. Why, by Jove, it smashed two lookers to atoms and penetrated an inch of deal! Thank God it had the good sense to fly away from me, or my experiments would have ended then and there."

"Hm," I observed. "But why doesn't the thing rise higher—up to the limits of the cone of—or, what you call force-vacuum?"

Sir Esme shook his head. "I am not quite certain myself," he admitted, "but I think it is because the friction or the resistance is greater than the lifting power of the affected area. It is in a reverse way somewhat akin to the phenomenon of a falling body. Theoretically, a falling body should increase its speed as it drops—that is, the farther it falls the faster it should fall! but as a matter of fact, owing to friction and resistance of the atmosphere, its speed, after a definite fall is reached, remains constant. But that, my friend, is where I have made the great discovery, the discovery that so excited me."

"Good Lord!" I exclaimed, "I thought what you have just told me was the discovery. You don't mean to tell me there is more coming?"

"This is merely the beginning," he assured me. "The real discovery came through a device by which the force, if I may so term it, of the repellent area was intensified—exactly as you or I or anyone can focus the lens of a lantern or a stereopticon. And by increasing the force or the intensity of my repellent beam as the object ascends, I can send the thing sailing upward for an indefinite distance—for all I know into space itself."

"Then you could project a vessel or a device into space so the earth would rotate beneath it and the device—the vessel—would, in effect, travel westward as our planet rolls on home," I exclaimed.

"No," he declared, "that is impossible. The repellent beam would have to follow the object to accomplish that, and the beam is fixed—it is projected straight-radially, from the earth and at right angles to the earth's surface. But—" Sir Esme paused, leaned forward and spoke impressively—"I have discovered a most astonishing and yet logical thing. If an object is lifted by my device to a great height above the earth, it either completely vanishes or returns to the earth at a spot some distance from where it started."

"What?" I ejaculated. "You mean you actually have well—or, blown things into space?"

"I cannot positively say," he replied. "But I do know that, in several instances, objects fell back to earth several feet—even a number of yards from the point where I projected them, while others, projected to a greater height, have never returned."

I laughed. "Pardon me," I cried, "but that does not prove that they actually vanished. In fact your statement that some fell back at a considerable distance from where you sent them seeming indubious to my mind that the others merely descended beyond your sight or hearing. But come, where and when did you make these tests? I'm mighty sorry I could not have seen them."

He grinned joyfully. "I—or rather we, for I must include Harvey—conducted them on Sir Esme McDonald's property in Yorkshire. There is quite a large lake in the midst of the moor—a lonely uninhabited spot—and once I discovered that the objects did not return to their starting point, I made use of the lake in order, if possible, to determine if they descended near and if so at what distances from the apparatus. You see, I thought at first it might be the result of wind or other simple causes. But I soon determined to my entire satisfaction that they fell always northwest of the point of departure, and that the distance varied in exact ratio to the intensity of the nullifying beam employed. So—"

"So that proves my contention," I interrupted. "Those that were sent highest fell proportionately farther away and out of your range."

He shook his head. "I thought so myself—at first," he said. "But the strange feature is this. I adjusted—or I might say graded—the focus so as to project the objects (in this case they were iron cubes) higher and higher by degrees. In each case the cubes fell back in the proper ratio of distances until a certain power or focus was used, whereupon none returned. Now, my dear sir, you must admit that if it was simply a matter of their falling so far distant that they were beyond our loss, there would have been intermediate falls, just as there were intermediate beams used. And—" Sir Esme leaned forward and tapped my knee for emphasis—"a number of the cubes—those that fell furthest away—were partially disintegrated—the corners, the edges were torn away! I am sure—I feel positive that the speed of rotation of the objects increases with the distance reached above the earth, and that at a certain distance the rotation speed becomes so great that the objects are completely disintegrated—blown to atoms. No doubt," he continued, "various substances lose their cohesion at various heights—they must of necessity, as their tensile strengths vary—and I intend to make exhaustive experiments covering this feature."

He paused.

"Wonderful!" I declared, "but pardon me if I reminded you of it. You stated that many wonderful discoveries possessed no real value. And personally I cannot see what value this discovery possesses, if, as you say, a thing is liable to go to pieces, and the most that can be done is to elevate an object and let it drop back to earth."

Sir Esme rose, stuck his hands in his trouser pockets, puffed once or twice at his pipe, and gazed steadily at me from under knitted brows.

"The value is," he announced in level tones, "that the discovery will, unless I am vastly mistaken, solve some of the greatest mysteries that continue to confront the human race."

CHAPTER IV

Explaining Mysterious Disappearances

FOR a moment I stared at him, almost convinced that he was not quite himself. Then I laughed.

"Of course!" I exclaimed, "the mysteries of gravitation, of why things on this old earth stay 'put' as I might say, the—"

"Nothing of that sort!" he interrupted impatiently—"Mysteries of gravitation, field-theories! The force itself solves that. No, by God! what I mean are human mysteries—matters that touch us personally; not any abstract, scientific puzzle, but real, vivid, human mysteries such as—well, the mystery of Harvey, for example."

I was absolutely amazed, thunderstruck to hear him, the intensely scientific student, speaking so ecstatically of science, to hear him rating human interests higher than scientific truths, and his reference to his discovery solving the mystery of Harvey's past. I was by now almost certain he had become mentally unbalanced; on the other hand I thought it might be only the strain of hard work plus the excitement over his discoveries. He was not the excitable sort and I had never before seen him in his present obviously nervous and keyed-up state. But then such an epochal and revolutionary discovery as he had made was enough to keep anyone up to the highest pitch.

"I confess I cannot conceive how your remarkable discovery and your most recent experiments have any bearing on Harvey's case," I said, speaking as if discussing a most ordinary matter. "How can—?"

But he did not wait for me to complete my question. "Of course you wouldn't," he cried. "I didn't myself at first. But the reason it will solve the puzzle of his past—just as it will solve other riddles, other mysteries—is because it was the cause of them."

This was almost too much. "Caused the lapse of Harvey's memory?" I ejaculated. "How can that be possible? How can a force—a gravitational vacuum, as you call it—be responsible for the loss of a shipwrecked man's memory? Do you mean that by some mysterious means a human memory is whisked into space like your iron cubes or is shattered into atoms?"

He grinned and I thanked heaven for that grin, for it proved he was still sane and was not as nervously excited as I had thought.

"No, not quite that," he replied. "But—" he moved quickly to a chair, seated himself at his lettered desk and reached for a sheet of paper, a pencil and a map that I had noticed lying open on the desk. "Just come here and I'll try to make it all clear to you," he said in quite his normal voice. "Of course," he added, "you think I'm mad as a March hare and I cannot blame you. But as a matter of fact it's all very simple—that is, the solution of the mysteries is simple. I admit the confounded force and the laws that govern it and the formation of these vortices are the very reverse of simple. But now I have the key to them—the fundamental idea as it were, the positive I can work out the details. But—well, let us start with Harvey's case. You remember I told you I picked him up at sea—" I started involuntarily and cast a covert glance at my friend, for never before when in his Alexander McDonald ego, had he referred to himself in the person of Sir Esme. But he appeared oblivious of the slip and of my surprise, for he was busy jotting down figures and marking spots on the map.

"I picked him up right here," he continued, "yet, as you know, I searched all records and am positive that no vessel was wrecked within hundreds of miles of the spot—that is no vessel had been wrecked in that vicinity at that time or near it, and no vessel that by any possibility could have been in the vicinity had been reported as missing. Yet there he was, floating, lashed to a piece of wreckage and unquestionably shipwrecked not more than twenty hours previously—probably not more than three or four hours."

"Yet—" Sir Esme wheeled, his eyes half-shut under his bushy brows and his finger tapping out the words on his palm, "yet I have every reason to think that Harvey, as we know him, was actually wrecked more than one thousand miles distant from the spot where he was picked up!"

"What?" I ejaculated. "Why, why that's impossible! You say he could not have been in the sea more than a few hours and it is manifestly ridiculous to believe he could have drifted a thousand miles from—"

"Reflexions! Impossible!" he cried, interrupting my words. "A short time ago, if I told you I could nicely eliminate the thing known as weight—that I could cause a lump of lead or a piece of iron to move away from the earth by the elimination of a force hitherto unknown, you would have declared my statements ridiculous and the best impossible. Now, honestly, am I not right?"

I laughed. "Yes, I presume you are," I admitted. "But this, well, that is different."

"Is it?" he queried, raising his eyebrows. "I do not think so, for I feel convinced that Harvey was transported for more than one thousand miles by the same means by which the cubes of iron used in my tests were shot into the air and transported for considerable distances. In other words, my friend, I believe that, in nature, under certain conditions, in certain places and—thank God—very rarely, gravitational vortices are formed precisely like those my apparatus produces, but on a far larger scale. I do not pretend nor attempt to explain why or how these are formed, I do not have the faintest conception of why they should occur, what produces them, why they are not more common. But I do know that they do occur. And I base that assumption on two basic facts. First, what I know of the phenomena I have artificially produced, and second, because there is an other plausible theory to explain certain occurrences that we know take place and have taken place for ages—as the back as there is history. You have heard of the mystery of the *Marie Celeste*?" he demanded, suddenly altering his tone and abruptly changing the subject.

I nodded. "Certainly," I replied. "The vessel—a bark I believe—that was found, with all sails set, her boats at the sterns, everything in order on board, but without the trace of a living soul."

"And no plausible explanation of the mystery," he observed. "Well, by Jove, the gravitational vortex explains that mystery. And it explains scores of others—the showings of fishes, of frogs so widely separated; whirlwinds, tornados, water-spouts. It explains the baffling but authenticated showings of stones in the West Indies and elsewhere, it explains the mysterious, the inexplicable and yet unquestionable disappearances of human beings—the bodily vanishing of men and women; it explains many of the seeming miracles of Biblical and other history; the missing elms and—" he leaned forward and spoke earnestly, impressively—"it explains something



that affects us of today more closely, far more vitally—the tragedies of the air—the airplanes that have vanished, leaving no trace on transoceanic flights, etc.—” his voice broke—“the crashes, without apparent reasons, that have caused the— the deaths of so many gallant and splendid young men.”

FOR a moment he was silent, a pained expression on his face, and I knew that his thoughts were of his lost son. And then suddenly his face cleared, and to my amazement, my utter astonishment, it was Sir Esme and not the scientifically inclined Alexander who was speaking.

“My dear friend,” he said. “All the years that I have spent in scientific research have been with this one object in view. Long before that tragedy of my life of which I cannot even now bear to speak or even think, I became obsessed with the idea of solving what are to me the most mysterious occurrences that ever have taken place. Never have I believed in the supernatural and I have always felt convinced that there was nothing that could not be explained by natural causes provided we understand those causes.

“As Sir Esme McDonald it would have been impossible for me to have turned to scientific work and to have been taken seriously. Yet I longed to delve into the mysteries of research. So I invented Alexander McDonald the scientist and—” he smiled and his eyes twinkled—“so thoroughly did I become Alexander, or perhaps I should say so thinly veiled was Alexander by Sir Esme, that in time I became, to all intents and purposes, two distinct personalities. But now, now that I am on the verge of solving those mysteries which have always interested me, Sir Esme and Alexander must merge, for the work I have in view can only be carried on by means of Sir Esme’s wealth and Alexander’s scientific knowledge combined.” He laughed. “By God!” he cried, “I believe you’re the only man who ever saw two men become one.”

“Or one man become two,” I observed. “But, frankly, though I am, of course, quite willing to be convinced, I do not even yet understand how this force you have discovered, or the absence of the force—and by the way, why not call it *Esmeism*—how this Esmeism or its absence can account for all the phenomena or the puzzles you have mentioned.”

“Esme!” he ejaculated. “You’ve found a name for the force, and so it was not discovered by Sir Esme but by the studious Alexander, I can accept your name for it without feeling galled. But seriously, my friend, cannot you see how simple it is? For some reason, as yet inexplicable, an Esme-like vacuum—*now*, what an expression!—takes place over a certain spot on the surface of the earth or sun. And instantly everything in the area of that vortex of non-attraction—*no*, by God, of repulsion to the planet’s surface, flies away from the earth.”

“I can understand that,” I admitted. “But if for

“Well, it’s downright uncanny,” I said, staring at the bit of lead still poised midway between the table and ceiling.

the sake of argument such a vacuum or vortex would disappear, whereas, as in the case of the *Maria Celeste*, only the persons aboard were missing. And also, why would the earth or the water not follow?"

Sir Esme shook his head as if in despair. "Don't you remember," he queried, "that I explained that the weight of the object lifted or moved depended upon the size of the area where the force—no, confound it, the Emission, was absent or interrupted? The effect is precisely as if a magnet were suspended above a bit of iron or steel. The larger the magnet the larger the piece of metal it can lift, or perhaps I might better say for purposes of explanation that the same magnet that would lift twenty pounds, if within a few inches of the object, would not move that object if separated from it by a few feet. Or again I might compare the area of attenuated Emission to a beam of light as I have done before. A beam of light may be focussed to a point upon an object or it may be widely diffused over the same place, and so it is in the case of these inverted, cone-shaped areas or vortices of atmosphere freed, by some unknown means, of the force that is called gravitation. But with a great difference; whereas the diffused light is less powerful than the concentrated light, the reverse is the case with Emission. See—" he detached rapidly upon a sheet of paper—"here we have two inverted cones, one with its apex just touching a plane, the other like an inverted, truncated cone with a considerable portion of its section touching the same plane. You readily see that in the first case only those objects directly under the apex of the cone would fly upwards, whereas in the second place all the objects that came within the area of the truncated cone's section would be affected.

"Now, in my experiments I have always, necessarily, been operating with a vortex whose apex represented my apparatus, and hence only very small objects directly in line with the apex were affected. But in nature, in the case of the phenomena that I am sure occur, a considerable area may be affected, and hence large—extremely cumbersome objects, such as entire ships may be relieved of all—well, gravitation, as it is called. And unaccountably, in nature, as in my experiments, the force, or rather the absence of force must vary."

"But," I objected, "Although I can quite understand all that, yet I cannot understand how a mystery such as that of the *Maria Celeste*, or of Harzey, or even the disappearance of a single human being, can be explained by your theory."

"Theory, both!" he exclaimed impatiently. "It's not a theory it's a demonstrable fact. And why, pray, are not these mysterious occurrences explicable by it?"

"Well," I said. "I'm not a scientist as you know, Sir Esme. But it seems to me that in any of the cases I mentioned, or in any similar case, the results do not fit the cause, or I may put it in that way. For example, the *Maria Celeste* was in perfect condition, not a thing disturbed aside from the fact that all human beings were missing. And in the case of a man or woman vanishing—as many have, I admit—how could one individual be whisked away from a populated spot without others being disturbed, without someone witnessing the marvelous occurrence and without the victim making an outcry? And as far as whirlwinds—tornadoes—water-spouts, showers of fish and such things are concerned, why they have been otherwise explained long ago."

Sir Esme burst into hearty laughter. "Of course they have!" he cried. "So has the matter of gravitation, of volcanic eruptions, of sun-spots, of electro-magnetic force and source of others. But do you, does anyone, recall a single explanation that has not upset some poor explanation that had been accepted as incontrovertible fact? Not a bit of it. Man puzzles over some phenomenon in nature; he manufactures a theory, an explanation that seems to fit the facts, and until some other man discovers the truth—or hits upon a more plausible theory—everyone swallows it and is satisfied.

"Because an apple fell on Sir Isaac Newton's head, his curiosity was aroused; apples, all other objects, dropped towards the earth, so naturally—he and his followers—argued that everything must be attracted by the earth, and they christened this purely theoretical attraction, gravitation. But it never occurred to any of them, that the same results would follow if the objects were impelled or pressed towards the earth from outer space. No, indeed, because man—yes, even scientific man—cannot readily conceive of anything earthly being subject to extra-terrestrial forces, everyone looked to poor old earth for the source of the force that caused the apple to fall. But that does not answer your questions, your doubts. Can you not conceive how, if you, if I, were walking along or standing—well or were sitting here and one of those inverted vortices of interrupted force—no, Emission—should by chance form directly above you, so that its apex was poised directly over your head, you would be sucked up as it were, without in the least affecting me, here within a few feet of you? And—"

"Yes, yes," I interrupted, glancing unconsciously upward as if half-fearing the tragedy might be hovering over me, "but would not my chair, the rug, the floor, even the earth directly underneath, also fly upward?"

SIR ESME shook his head. "Not necessarily," he declared. "If the apex of the vortex, as I must call it—though it is not a true vortex—if the point, the focal point, as I may say, was upon you, nothing beneath you would be disturbed any more than a beam of light concentrated upon a sheet of paper and burning a hole through the paper would burn objects beneath it and out of the focus of the light beam. But should the apex of the vortex be beneath you then, my friend, you, your chair, everything movable within the area of interrupted Emission would, as you say, go soaring upward."

"I'd get a nasty bump when I struck the ceiling," I observed, "or would a section of the ceiling and roof vanish and leave a clear exit for me?"

"No, that is a rather remarkable feature of the thing," he replied. "Only movable matter appears to be affected. As long as any object is attached or fixed to another object outside the sphere of the vacuum, if I may so refer to it, it remains in situ. I—"

"But surely if a ship—if a large heavy body would fly off the earth's surface, mere nails, screws, bolts or other fixtures could not hold things in place," I objected.

"It is not the strength of the fixtures," he said slowly and thoughtfully. "I have carried out some rather interesting tests to determine that. Yes, by Jove, damnably interesting and devilishly mystifying. With my device for creating a small area of Emission, I could lift lead, iron, any material, until it came into contact with some fixed object. There it stopped. And—well, this is the most amazing—but hold on, come into the laboratory

and I'll demonstrate it. I'll show you something that will make everything you have seen or that I have said, appear commonplace and simple."

Rising, he led the way into the room where I had first witnessed his astonishing demonstration, and having adjusted and arranged his apparatus I again gazed, almost as incredulously as on my first visit, at the piece of metal that floated, light as thistledown, into the air. But this time, instead of remaining poised, it shot with ever increasing speed upward, struck the ceiling with a resounding noise rebounded, swung up again and finally came to rest against the ceiling, where it remained as it glided in place.

"You observe," remarked Sir Esme, "that despite the fact that the Esmeism-free area extends above the ceiling, the iron cube cannot pass through the plaster and the rafters. And neither do the materials, of which the ceiling is composed, fly into space as, heretofore, all supporters of the gravitational theory would have no believe would be the case were gravitation to be suddenly cut off. And now I will give you an even greater surprise. As he spoke, he pressed a switch; the iron cube dropped back with a bang to the low table where it had originally rested, and Sir Esme produced a sheet of thin cardboard with long cords attached to the four corners. Fastening these to hooks in the walls, he suspended the cardboard sheet above the piece of metal."

"Now," he remarked, "if I produce an Esmeismic area to include both the iron cube and the suspended card, what do you imagine will occur?" I smiled. "Had you not already assured me that objects attached to other objects outside the sphere of influence are not affected? I should say without hesitation that the cardboard and the iron would rise to the ceiling. As it is, I cannot believe that those slender bits of twine can restrain the card acted upon by a force, or rather a lack of force, strong enough to levitate a block of solid iron."

"Here is the answer!" he exclaimed.

CHAPTER V

The Esmeismic Force

AS Sir Esme spoke, there was a sharp click and I gazed speechless with wonder, even though I had been somewhat prepared for what I saw.

Again the iron cube had flown upward as if hurled from a hidden spring and had struck the suspended cardboard. But instead of tearing through it, or snapping the strings that secured the card in place, the piece of metal secretly lifted the card a few inches and then remained, pressed against the fragile barrier as though the cardboard had been a sheet of steel!

Sir Esme grinned and chuckled triumphantly. "Now what do you think?" he cried exultantly.

"I'll be hanged if I know what to think," I admitted. "Why the deuce didn't the iron go through the cardboard at least once upward?"

"That's the identical question I asked myself," he replied. "And I can assure you that it amazed and puzzled me fully as much as it does you. Now watch closely and I'll show you another miracle."

Once again he allowed the iron to sink back to the table. "I am about to demonstrate to you the truth of my deductions in regard to the inverted cone or vortex," he informed me. As he spoke he was arranging a second

sheet of cardboard suspended a few feet above the first. Then he stepped to the low table and placed several identical iron blocks upon it and a few inches from one another. "These," he observed, "might represent so many human beings and what you are about to witness will, I think, answer one of your queries, and will amply prove the truth of my assertions. This one," he indicated the cube he already had used, "is, as you will notice, resting upon a mark that represents the exact apex of the inevitable vortex I am about to produce. The others are slightly outside the apex. Now," again he touched the switch and once more the iron soared upward and came to rest against the lower surface of the suspended card. But not another of the cubes moved. "You see," said he, "that only the cube at the apex of the cone was affected. Now if my deductions are correct, if the affected space is in reality an inverted cone, there will of necessity be a wider, a larger area of interrupted Esmeism on the suspended sheet of cardboard than upon the table. Do you grasp my meaning?"

I nodded. "Certainly," I assured him. "I can imagine an inverted cone, its apex resting upon the table and intersected by the two sheets of postboard. Naturally the uppermost sheet will block the imaginary cone where its diameter is greater than where it is bisected by the lower sheet."

"Precisely," he agreed. Again he permitted the levitated iron to drop back. Then he picked up the others and placed them at varying distances upon the first of the suspended sheets, marking with a pencil the position of each. "Now watch," he cautioned me, and once more set his concealed apparatus in motion. Now I had, I felt, begun to grasp the whole idea. I had begun to take the astonishing facts he performed as a matter of course, and what he had told me should have prepared me for the results that followed.

Yet I could not repress an exclamation of wonder as the first cube flew up and, at the same instant, three of the cubes upon the cardboard rose as if possessed with life until they rested against the upper sheet.

Sir Esme's eyes twinkled under his bushy brows. "Fanny don't, so you Americans say, isn't it?" he chuckled. "But do you notice that the three cubes resting against the second barrier are more widely separated than when they were placed upon the first?"

I had not noticed, but now that he drew my attention to it I saw he was right. "I'm sorry I cannot mark their precise positions," he said, "but the confounded thing is still too unstable and is too much the experimental stage to permit me to insert my hand or any portion of my anatomy within the sphere of the vortex. I'm no coward but—"

"Don't try it, for heaven's sake!" I cautioned.

"I have no intention of doing so—just at present," he assured me. "But as I was about to say, if I could mark the positions of the cubes, it would simplify matters for you. However there are more ways than one of showing an act—or was it a act—as the old saying goes."

Once more he caused the various suspended pieces of metal to resume their former positions. Then he removed them from the first sheet of cardboard and placed them at much wider distances apart upon the upper sheet, marking the position of each as before.

By now I was prepared for almost anything, and it did not greatly surprise me to see the cubes fly upward and strike the ceiling like a charge of exaggerated shot.

"I think you will agree that they are far more widely separated up there than when they rested upon the card," said Sir Esme, glancing up at the bits of iron dabbing the plates above us. "And" he continued, "you noticed that whereas only three left the first sheet and the others, a few inches further from the center, were not disabbed, all those that were resting on the second sheet were lifted, although several were twice the distance from the center of the sheet, as were the others. Now do you agree that I have proved my contentions in respect to the inverted cone of vortex?"

"I most assuredly do," I declared. "But for that matter I never questioned that contention. That was to me perfectly reasonable and logical. In fact, speaking as a layman and not as a scientist, I should have assumed that any force or rays projected from the surface of the earth in all directions—or focused upon the earth's surface—would of necessity impinge or emanate at angles—that they would radiate like the spokes of a sea-urchin or the spokes of a wheel, and hence if considered in small groups, would form what might be termed layered cones."

"Hear! Hear!" cried Sir Esme delightedly. "A crucible, a brilliant speech! But—" he seriously—"all joking aside you have grasped the idea perfectly."

"However," I went on, "I do not yet see how you can account for such mysteries as Harvey's memory and the *Maria Celeste* by these amazing properties of your force. And I would like to know—provided you can explain it—why or how a sheet of cardboard stops lamps of iron from moving upward, why the sheets themselves are not lifted, and what is still more astonishing and inexplicable to me, why, if the cards stop the iron humps and are not themselves moved, objects placed upon them rise."

"I'm very sorry to have to admit that I cannot fully account for that myself. But I think it a sort of 'grounding' if I may use the term. In other words I believe that any object connected, ever so lightly, with objects outside the sphere of the vortices, is, so to say, grounded to those outside and hence is not affected. And to a certain extent such objects are insulators."

"Although, as you saw, the cubes placed upon the cards were affected and rose upward, yet my tests have proved that the force or absence of force becomes less after passing through such objects—filtered as it were. In fact, had I placed a dozen or more sheets above my apparatus, the cubes, if placed upon the highest sheet, would scarcely have been affected. Now of course with the influence reversed, coming from outer space towards the earth, this might not be the case. Yet I am convinced that it is and I am convinced that it is due to these still mysterious and inexplicable laws of Esmeism that, in all cases of vanishing persons, ships, *et cetera*, all have taken place in the open air. I do not know of a single case of a human being vanishing when within a building."

"All very well and good, Sir Esme," I assented. "But I am still harping on the same subject. Can you give me a logical and lucid explanation of how or why the human beings on the *Maria Celeste* vanished without any portion of the ship being disturbed, provided they were, as you claim, carried off by one of your Esmeistic cones forming over the ship?"

"Of course I can!" he declared. "It's very simple. But I'd forgotten to mention that in the course of my tests and experiments I discovered that the susceptibility of various substances to the release of Esmeistic force

varies greatly. Organic matter is affected much less than inorganic matter for example, and metals are affected more than wood and other substances."

"That fact has a great bearing upon the baffling mysteries you mention. Briefly then, my theory is this. The *Maria Celeste* passed through or came within the area of influence of one of these vortices—one of minor intensity or power, as I might say; but which was sufficiently powerful to cause all human beings on deck to be carried into space—together with the dog and cat (you remember they, too, were missing). And—"

"Hold on!" I interrupted. "How about the men below decks? And how about objects on deck?"

"No doubt," he continued, oblivious of my interruption, "any persons who may have been below deck came on deck owing to unwanted sounds or possibly cries. I feel sure these vortices move about, and it is quite possible that in this particular case the persons were not all lifted into air at once, but some were seen to vanish by their terrified comrades who, paralyzed with superstitious fear, made no attempt to escape a fate of which they were totally ignorant. And as regards articles upon deck! how do we know such objects did not vanish? It was reported that boats, deck fittings, hatch covers, etc., were undisturbed, but all objects attached or even lashed to the vessel would have remained, as I have demonstrated."

"It seems utterly incredible," I declared. "Yet I admit it is no more incredible than the known facts and not as incredible as many of the theories advanced to explain the mystery. But granting it *did* occur as you say, how about Harvey and the other crew?"

"Harvey!" exclaimed Sir Esme. "I am convinced Harvey was upon that Spanish vessel that vanished, leaving no trace. I believe that the ship came within the area of an Esmeistic vortex; that it was swept upward, and the portions of it—including Harvey—were dropped back to the sea a thousand miles from the spot where the ship vanished."

I was absolutely dumbfounded at Sir Esme's words. That any sane man could propose such a wild impossible theory, even if his deduction in respect to the *Maria Celeste* and other mysteries were correct, seemed absolutely preposterous, yet Sir Esme seemed sane, normal and absolutely sincere. In fact he appeared to sense nothing very remarkable, and certainly nothing incredible in his amazing statements.

"Good Lord, man!" I gasped. "How could he—how could any man—survive such an experience?"

"Men have survived worse," he commented laconically. "And the very fact that he was nearly dead and had lost all memory proves he had undergone some terrible experience, something worse than mere immersion in a tropical sea for a few hours. Everything points to the truth of my deduction. Did I not tell you that the objects I projected to extreme heights always fell back to earth at some distance to the southeast of the spot whence they departed?"

"And I have made careful calculations and am positive that a vessel, lifted or propelled or levitated—whichever you prefer—at the position in which the *Santa Inez* was or should have been at the time of her disappearance, would have returned to the earth—in case she returned at all—in or very near the precise spot where I found Harvey floating on his bit of wreckage."

"But," I objected, "In that case why were there no others—no other bits of wreckage to be found? And why should the ship or anyone on her return to earth? Admitting, for the sake of argument that your theory is correct—that the *Marie Celeste*, the *Santa Inez*, any ships or other objects, were lifted, whisked into space by such a phenomenon, why should they or any portion of them return to earth? Why, Sir Esme, that would defeat your own arguments. If such were the case, why is it that some of the persons who have vanished—the crew of the *Marie Celeste*, for instance, have ever been found?"

"Plenty of reasons and logical ones," he declared positively. "An object—even a ship, drawn or forced or whatever you may call it, into the air by one of these Emerician vortices if, in the center of the area, would no doubt be lifted so far that it never returned, or it might be completely disintegrated by its insupportably rapid rotation; whereas, if the objects were near the outer edges of the vortex, so to say, or at the vortex were weak or, as very probably occurs, the area of Emericism is merely temporary and of brief duration, then, in either case, the objects might be lifted for only a short distance and might be dropped back to earth. I can perhaps make my meaning clearer by calling your attention to the phenomena of a whirlpool. Although many objects may be drawn into its center and sucked down forever into its vortex, other objects are constantly thrown out, and even after being caught in the rotating currents, escape and drift safely away. Such—"

"But even if the objects that had been lifted did drop back they would be shattered by the impact with the earth or sea," I continued, cutting off his words.

He smiled and shook his head. "On the contrary, objects levitated by the Emerician vacuum do not drop back with any force," he informed me. "You may not have noticed it, but if you had given the matter attention you would have observed that the iron blocks, the bits of lead that I caused to rise in the air fell back gently with an appreciable impact upon the table below them. That is a most remarkable feature of the action of the force.

"It appears to me that the area of Emericism cannot be suddenly replaced by the normal force but regains its normal state rather slowly, thus allowing suspended or levitated objects to sink back almost as if they were being lowered by mechanical means."

I had not noticed this feature of the experiments he had made for my benefit, but now that he called it to my mind I remembered it was so. The lifted cubes of metal had struck the ceiling with quite an appreciable and forceful impact, but they had dropped back to the table with no noise, and as I recalled it, as lightly as though they had been bits of cotton. In that case why shouldn't a human being be projected upward and dropped back as gently as though attached to a parachute and winged? But to be carried a thousand miles before being dropped! That was too much. But Sir Esme was again speaking.

"What's so remarkable about it?" he demanded, as if reading my thoughts. "There are plenty of authentic instances of men, of animals, even of young children being whisked into the air by cyclones or tornadoes, carried a mile or more and dropped unharmed. And if my conclusions are correct—and I am sure they are—cyclones, tornadoes, waterspouts are all merely the manifestations of these same Emerician vacuums. And if you or anyone else can suggest a more credible or a more reasonable

hypothesis to account for the disappearance of the *Marie Celeste's* passengers and crew, I should like to hear it. It isn't as if her case were the only one. The same thing has occurred repeatedly, and when a mysterious, inexplicable thing of that sort is repeated, we may feel sure it is the result of some natural, if unknown law of nature. Can—"

"You mean to say there have been cases similar to that of the *Marie Celeste*?" I interrupted. "I always thought hers a unique mystery."

"Not a bit of it," he declared. "Why only recently—less than two years ago—the crew of the *Kobowah* vanished in the same baffling manner. Didn't you ever hear of it?"

"I believe I read that such a vessel—she was a training ship for the Danish navy, was she not?—was lost with all hands."

"Exactly," he said. "And in that respect only did her case vary from that of the more famous *Marie Celeste*. The latter ship was picked up and towed into port whereas the *Kobowah* disappeared—foundered or went ashore—and was lost. But—"

"There doesn't appear to be anything mysterious in that," I observed. "—"

"Not so fast!" he warned me. "The ship, as I say, was lost—but, long before she was lost she was seen, sailing, unharmed, without a soul on board."

"You mean—" I began, but he checked me with a gesture.

"On January the twenty-first, 1929, the *Kobowah* passed the island of Tristan da Cunha under single jib, forestal and lower topsails. She passed the island within a quarter of a mile from the shore. She was seen and watched by the islanders, several of whom possessed excellent glasses, and to their utter amazement not a living soul could be seen aboard and no man was at the ship's helm! She came very near striking a reef but was carried aside by a swirling of the wind and the current and vanished in the mist. But all agreed that she was uninjured, her sails, as far as seen, were whole, her furled canvas was in perfect shape, her boats and deck-fittings were in place, although she was slightly down by the stern. From that day to the present, no sign of the great ship nor of her crew of fifty naval cadets has ever been found. She left Montevideo on December 14th. On December 1st she noticed that all was well, and on January 21st, she was abandoned but seaworthy vessel with sails and all intact. Had she been picked up she would have proved an even greater mystery than the *Marie Celeste*, but beyond doubt she went down soon after passing Tristan. An unmanned ship has little chance of surviving long. And there is another case I might mention—that of the steamship *Elkton* that sailed from Swansea in November, 1928.

"And there was a case that in some respects resembles that of the *Santa Inez* and *Harvey*. A week before the *Elkton* sailed from Swansea, laden with coals, she was found ashore at Chapel Porth in Cornwall. Ashore within 200 yards of the beach. Not an unseaworthy thing, you will say; but—there was not a soul on board; her boilers were cold; there were no papers, no log, nothing movable left in the cabins or on deck and there was not a ton of coal in her hold! Yet, aside from a hole knocked in her bottom by the rocks where she came ashore, she was uninjured and her boats were intact. But—here is the most amazing feature of all—the fra-

ture that I feel proves my conclusions. More than twenty vessels were anchored in the harbor during the night that preceded the discovery of the *Eltham*, yet not one had seen the ship enter or go ashore! I—"

"You mean you actually believe she had been carried up by one of those vortices and had been dropped on the Cornish coast?" I cried.

"Absolutely!" he replied. "Otherwise how can you account for a staunch six hundred ton Welsh collier, bound from Swansea to Roslyn, dropping unaccountably into a cove on the coast of Cornwall? And how can you explain the absence of her crew, of every movable object aboard, even of her cargo? I am positive, certain as I am of anything, that the *Eltham* was hurled into space by coming in contact with an area of Eusebian, that she was carried for miles, to be dropped eventually on the Cornish Coast and that during her amazing journey her cargo dropped out or rather was carried away by the same phenomenon that lifted her from the sea."

I LEARNED back utterly unable to voice my astonishment, hardly able to think steadily and coherently. The facts faced on and, as Sir Esme had said, no credible hypothesis other than his seemed to fit the cases he had mentioned. And yet his theory was as incredible as the mysteries it purported to solve. For a few moments he busied himself with the map. Then he turned again to me.

"Those are merely examples," he observed. "I might also mention the unexplained disappearance of the *Cyclops*—the naval frigate of your country, that, laden with manganese from Brazil, vanished completely when off Barbadoes. And if we search through the maritime records, we will find hundreds, thousands of cases of vessels reported as missing, of which no trace ever has been found, and yet vessels that were staunch, sound and were not in the vicinity of storms when they disappeared. They—"

"Collisions might account for them or—"

"In which case the vessel in collision would have reported the accident," he reminded me. "And," he continued, "although I am very familiar with ships and shipping and maritime casualties, I do not recall a single instance where two vessels disappeared coincidentally in the same vicinity, as would have been the case had there been a collision that sent both to the bottom. No, my friend, my theory, or rather my discovery is the only plausible explanation. And leaving ships aside for the time being. How else can you explain such mysterious disappearances as that of Dorothy Arnold, our countrywoman, who vanished in broad daylight in New York City, leaving no trace? There are scores of similar cases. I know personally of one gentleman who vanished as completely and even more mysteriously in the West Indies, and who—now you may not believe this but I can readily verify my statements—was seen and spoken to by a policeman at a spot more than twenty miles from where he disappeared, within ten minutes after he vanished! And exactly as in Harvey's case, he seemed numb in mind, dazed, completely out of his head. Unfortunately he disappeared the second time—though that was easily explainable, for he was seen at the verge of a treacherous lake and in his mentally chaotic condition no doubt was accidentally drowned. Moreover, on at least two occasions, I know from trustworthy observers, that people who vanished—actually one might

say before their comrades' eyes—disappeared in whirlwind-like columns of sand and dust; exactly what might be expected as a result of one of the Eusebian vortices."

"Good Lord!" I exclaimed. "Come to think of it one of my relatives vanished in much the same way. It was in Maine. He had left the house one winter's night to get a bucket of water from the well. No one ever saw him again. His footsteps led half way to the well and ended there. There was a fresh fall of snow on the ground and—now I recall the details as narrated by my father who was there at the time—there was a peculiar round depression in the snow just where the footsteps ceased. It—"

"By Jove, a perfect case!" cried Sir Esme as triumphantly as though he had made a fresh discovery. "And," he added emphatically, "that helps me a great deal. It carries my sphere of occurrences a bit farther north than I had been able to trace it. I—"

"Your what?" I queried, unable to understand what he meant.

"Just what I said," he replied. "See here—" indicating the chart on the desk—"I have been marking down the locations of every occurrence that I have been able to attribute to the Eusebian vortices. I have two as far north as New York, one in northern Ireland and now this one of yours in Maine. But as you will see, they are far more numerous in the tropical and semi-tropical areas than either north or south. That fact, I am sure, is most important."

I had been studying the chart as he spoke and noticed, as he said, that the marks—each of which was numbered—were far more numerous in the tropics than elsewhere, and that there were more marks on sea than on land.

"Evidently, if you are right in your belief, the phenomena take place more frequently on the ocean than elsewhere," I remarked.

"Hm, so I assume," he said, "but in that I may be mistaken. Very possibly it is because we hear of practically every ship that vanishes, whereas we hear of only a portion of the human beings who disappear. Moreover, I have not marked all the tornadoes, cyclones, waterpots, whirlwinds, and similar occurrences that are everyday happenings in many parts of the world, but I have indicated the areas in which they occur in greatest numbers and with the greatest frequency, and I have plotted their tracks as you see."

"Have you come to any conclusions regarding their occurrence?" I asked. "Do they appear to follow any definite laws or to recur repeatedly in or near the same spot? It seems to me that there should be some means of checking up and determining if they bear any relation to other phenomena such as sun-spots, air-currents, volcanic disturbances, the solstices or anything else."

"In a way I have," he informed me. "I am not at all sure that they do not remain constant or nearly constant at certain points. And I am positive that there are certain areas where they are very common. Such an area, I believe, lies about here," Sir Esme placed his finger on a shaded spot in the south Atlantic, "and another here." He indicated a similar spot in the North Atlantic.

"Why do you assume that?" I asked. "I do not notice any of your numbers in this north Atlantic area."

Sir Esme turned to me and laid his hand impressively upon my arm. "That," said he in low but earnest tones, "is because no one knows! No living soul has ever returned from there to tell what took place. It—"

"Surely," I exclaimed, "ships must pass there. It is almost in the regular lanes of transatlantic shipping."

"Ships, yes," he admitted. "But I am not referring to ships. I am speaking of serpents. Have you never wondered how or why so many airplanes, attempting to cross the Atlantic, have vanished? Have you never wondered why no traces of them have been found, why others—not better, not piloted by more capable men—have made the crossing safely? Here is the area where all these machines have vanished. Why? Because, if I am not vastly mistaken, it is an area where Esoteric vortices abound—vortices whose presence does not affect the surface of the sea—or at most, only slightly—enough to produce waterpots that abound in the area, but poised as it were, above the ocean—vast, terrible, invisible traps of certain death and destruction to all airplanes and aviators, who rush blindly, unwittingly into them."

"Pardon me if I seem to be a doubting Thomas," I said, "but honestly, is it necessary to account for missing airplanes by such a theory? Isn't it as reasonable to suppose that storms, fog, falling motors, structural faults or even air holes or similar causes accounted for the missing fliers?"

"Airplanes come to grief over the land, and if the same accidents occurred at sea they would be among the missing."

I could see that the subject was most painful to my friend, yet he controlled his feelings and spoke calmly.

"Do you know what percentage of aviation accidents and fatalities have never been explained?" he asked. "Why does a plane, in perfect condition, piloted by a skilled and competent man, flying in perfectly clear good weather, over a route it has traversed scores of times, suddenly crash without any apparent reason? Why does a trans-channel machine, that has made the crossing regularly and safely for months, suddenly turn, flatter like a wounded bird and fall? And what are these 'ice holes' you mention? What are the so-called 'dead spots' in the air? There is one answer to all these questions: areas of Esoteric. And though you may not be aware of the fact, airplanes have vanished as completely over land as over sea. The only reason there are more mysterious disappearances at sea, than where is because the oceans cover a greater area of the earth's surface than the land covers and because, as far as I can judge by this map and available data, the phenomena occur more frequently over water than over land."

"Can you suggest any reason for that?" I inquired, changing the subject of discussion.

"Possibly due to mountains, to forests, to many causes that exist on land and not on sea," he replied. "I am convinced that the vortices move about—travel from place to place—sometimes with great speed, and in that case they may be interrupted, broken as it were, by mountain ranges. We know that tornadoes, cyclones, water-spouts, are thus broken and I am sure they are merely manifestations of the same phenomena. But—" he rose and almost glared at me—"I intend to learn the absolute truth of all these matters. I intend to put my theories, as you call them, to a crucial test and if you wish you may have a part in my investigations. Within the week I will on the Leck Arrows to cruise about these areas I have indicated, to learn, if it is possible to learn, if there are such areas. Would you care to accompany me?"

CHAPTER VI

In Search of Vortices

FOR some reason—to this day I cannot explain exactly why—Sir Esme's announcement struck me as extremely ludicrous. It brought to my mind a flaring vision of Don Quixote tilting with the windmills, and I burst out laughing. But at the half-injured, half-tingly expression upon his face I controlled myself and led glibly in explanation of my ill-timed hilarity.

"Forgive me," I exclaimed. "I was not laughing at your surprising announcement, but at the thought of myself—something of an amateur regarding your theories—accompanying you. Of what earthly service would I be?"

"Sometimes," he remarked thoughtfully, "an amateur is far more useful than a true believer. As a matter of fact, my friend, your ignorance—pardon me for using such a coarse word—of science and your common sense objections and queries, have already been of inestimable service to me. You have enabled me to see things from the layman's viewpoint, to note the weak points in my deductions, and you have repeatedly called my attention to details, or to facts, that I might well have overlooked in my intense interest in following along prescribed lines. You have been in short, a check or brake as it were. And you have been a most delightful skeptic as I might say, in our discussions. I shall be immensely pleased to have you with me on the cruise and while I may fail utterly in my efforts to learn and study the Esoteric vortices—I can promise you a pleasant trip, possible excitement and, if all goes well, a unique experience and—danger."

"If all goes well!" I cried. "If all goes well, as you call it, we may share the fate of the crew of the *Marie Celeste* and the *Kobbenova*, I suppose you mean?"

Sir Esme grinned. "Quite possibly," he admitted, "although I scarcely expect so. I am not going to board the vortices in their den, so to speak, without being duly prepared. Of what value to me, to the world, would my observations prove, if I vanish? No, I am providing for every contingency I can foresee—though when dealing with unknown or almost unknown forces it is difficult to foresee all contingencies that may arise—and I believe, I have confidence, that we will not meet with disaster. But—"

"But if we do," I supplied, "it will all be in the name of science, eh? Well, I for one have no desire to be a martyr to that cause. I—"

"Then you will not accept my invitation?" he queried, and I could see he was disappointed.

"On the contrary, I shall," I assured him. "Frankly, I haven't yet been convinced of the truth of your theories or deductions. Mind, I do not for a moment question your discovery of the force I so glibly named Esoteric. Neither do I deny that you have proved much, in fact almost all that you claim, by means of experiments I have witnessed. But I do not admit that those tests or your discovery prove that similar phenomena occur in nature nor that the mysteries of disappearing human beings—our missing airships—can be attributed to such phenomena. Hence I haven't the least fear of being drawn or thrown or sucked, or whatever you may call it, into space. But I shall enjoy a deep water cruise. I shall enjoy your yacht, your excellent food,

your unparalleled wines and liquors, your cigars and—most of all—your companionship. And if you should trail down one of your durable old vortices, I shall be delighted to make its acquaintance, although I have no desire to emulate old Eljsh, nor to duplicate Harvey's experience."

"Topping?" ejaculated Sir Esme. "I was perfectly positive you would go along. In fact I do not believe a word that you say in respect to your dabbling in my theory. You are just as firmly convinced of the truth as I am. And speaking of Eljsh; ha, son, I am sure, was the victim of one of the vortices. And if I am not mistaken, he is the only man who actually was seen to vanish by such means."

"Hm," I observed, "I think you are wrong about that. Wasn't there an Aztec legend to the effect that Quetzalcoatl, the plumed-serpent, was borne heavenward by a whirlwind?"

"By Jove, you're right!" he cried. "I must put that down on my chart. That adds another area where the vortices have occurred."

"If you keep on, and create every old legend and myth and allegory, you'll find they occur everywhere," I told him. "In which case, why go to sea chasing the confounded things? Why not wait here in London until one comes along? And by the way, has one ever performed any of its stunts in or about London?"

"Not as far as I can learn; at least not within, well—two hundred years," he replied. "Nor has any happening that can be attributed to the vortices ever been reported from the black country of the Midlands or from any colliery district. I believe—in fact I am fairly certain—that smoke and fog are the greatest preventives of the vortices. In fact I depend for our safety—in case I locate a vortex—upon smoke-screens. Of course, it is, in a way, negative evidence, but I feel that is one reason why the preponderance of occurrences that I attribute to the phenomena have taken place in portions of the world where fog and smoke are non-existent or nearly so. I—"

"If you could only catch one of them and train it to hover over London at just the right distance above the city, you would be conferring a real boon on your fellow men," I told him. "I should imagine that it might prove the most efficient of fog and smoke eliminators."

"On the contrary," he informed me, "a London fog or London smoke would eliminate the vortices."

"Gosh!" I ejaculated, as a sudden idea flashed across my mind. "Isn't it possible you've got the cart before the horse? Isn't it possible that the prevalence of fog over London and other localities is due to the absence of your vortices instead of vice versa? Nobody ever has been able satisfactorily to explain why some places are foggy and others not—at least not to my satisfaction. Do you know, there are a lot of possibilities in your theory, Sir Esme—of a man could only believe in it."

"If there were not, I should not bother with it," he assured me dryly. "And the possibilities—I might even say the probabilities—are far greater than you, or even I, imagine. I am not at all sure that static, sun-spots, a score, no, better—hundreds—of natural phenomena are not all caused by, or at least do not have a direct relation to Esmeian and Esmeianic vortices."

"Well, here's hoping we'll make their better acquaintance," I said, rising to go. "But like yourself, I shall prepare for emergencies. If there is any truth in your

deductions, it appears to me that your inverted cones of non-existent gravitation are about as dangerous to monkey with as the powerful bus-son. I think I shall see my solicitor in the morning and have him draw up my last will and testament. But"—with a laugh—"I'm afraid it would be a difficult matter for him to prove my demise if I vanish. And wouldn't the old bird have a jolt if I should come sailing down past his window and drop into Lincoln's Inn Fields some fine morning!"

"The chances are that if you did you would not know where you went or who you were," he said. "You'd probably be in much the same mental state as poor Harvey, for I believe the action of the Esmeianic vacuum has a serious and inexplicable effect upon the human mind."

"That's comforting," I retorted. "But it might be interesting—and even convenient—to forget the past and start life as a new individual."

Sir Esme shook his head in despair. "I'm afraid you never will take the matter seriously," he lamented. "But before we are done you may find it serious enough. Good night, my friend. I hope to leave Portsmouth next Wednesday. But I shall see you again before then."

I SAW Sir Esme several times during the week that followed. And having, as he had surmised, been more than half convinced of the truth of his remarkable theory, I abandoned my flippancy, scoffing attitude and became intensely interested in his work, and especially in his preparations for locating possible vortices and in safeguarding his vessel and ourselves from their action. Very largely he depended upon two things for safety. One was the insulating material that he had invented, or I might say had discovered, and which, as he had told me, was an essential part of his appliance for creating artificial or synthetic areas free of the Esmeian. The second was smoke, to be produced instantaneously and in immense volume by devices he was having manufactured according to his own design.

As he took pains—and patience—to explain to me, he was not absolutely certain that either device would prove a safeguard. He was dealing with a new force, with unknown conditions, and very largely everything was theory and guesswork. But he had made exhaustive tests with smoke and had proved beyond question that his appliance was incapable of creating the so called gravitational vacuum or of lifting objects when the area above was filled with even a small amount of smoke. As he explained it, the smoke—composed of course of impenetrable masses of carbon—acted as a sort of coherer or binder to retain the Esmeian, although he frankly admitted this explanation was mere theory. The insulator, on the other hand, served as a sort of condenser or shield.

It was a most difficult matter for a layman to understand, for he was dealing with the absence of a force instead of its presence, and while I could conceive of a ray, a wave, almost anything being reflected from an object or absorbed by it, my mind could not adapt itself to the absence of a force, a vacuum as it were, being reflected, absorbed or acted upon in any way. The trouble was that my mind—although I knew better—would insist upon retaining the impression that the areas where Esmeian was non-existent were areas of actual vacuum—nothingness—whereas, as a matter of fact, they were identical with the rest of the atmosphere, except

that within them there was no gravitational pull (I must thus express it, although it was no pull but rather a push, according to Sir Esme) and they might be compared to shadowy areas where there were no light waves or areas of atmosphere where electro-magnetic waves were absent. But revolutionary matters that upset old preconceived ideas are always difficult for the ordinary non-scientific mind to grasp, especially when our senses—sight or hearing—cannot be brought into play. But as Sir Esme very pointedly and succinctly put it: it didn't make any difference whether or not I understood the matter as long as he did.

Also, he had collected—from what sources or how, the Lord alone knows—dozens, hundreds of authentic records of inexplicable disappearances, happenings and accidents which he attributed to his discovery. He had secured data of every cyclone, tornado and water-spout that had been recorded by the meteorological bureaus of the United States and foreign governments, innumerable excerpts from ships' logs, and he had delved into tradition and history, searching out accounts of similar phenomena.

All these he had correlated, tabulated and arranged, and had indicated them upon his chart until it was covered with dots and numbers. He was as delighted as a child with a new toy to find that his theories were being borne out by all this; that they were, so he assured me, portions of the sea and of the land where his areas of Emission were so numerous and of such frequent occurrence as to be almost constant, whereas in other sections they were practically non-existent, and he had worked out, and plotted by curves that made his map resemble a weather chart, their movements, for he was now positive that he was correct in his assumption that the areas did move. Not only that; he had, being intensely interested in astronomy, worked out a theory that the areas had a direct relation to planetary conditions, and he absolutely astounded me when, a day or two before we were to sail, he declared, apparently in all seriousness, that in his opinion the phenomena were not natural but were produced by the inhabitants of another planet.

"Why not?" he demanded when I derided this idea. "What do we know of the other planets or their inhabitants? It is absolute piffle to assume that any of them are not habitable. Why, damn it, the moon might be inhabited for all we know, or Venus or Mercury or Saturn—even the sun."

"Come, come," I cried, "what's going too far, Sir Esme. How could a mass of flaming gas, or a dead planet with no atmosphere, or a frozen sphere, be inhabited? Such ideas are merely phantasmal."

He snorted. "Why?" he again demanded. "I'll tell you why you and others assume such a stand: merely because you are judging or rather imagining all intelligence, all life, by the life on earth and by the intelligence of man."

"What is intelligence? Nobody can answer; but as it is not an organic nor a concrete thing, how can it be affected by heat, cold, atmosphere? In the case of man it is, I grant. Why? Because man's intelligence ends with his life, can function itself only by means of a chemical organic thing we call a body. But does that prove that equal or far greater intelligence might not exist without anything we would recognize as a body? Because we humans—in our terrestrial life—require certain conditions, certain chemicals and elements—certain

temperatures in order to exist, we jump to the conclusion that the same rules and laws hold throughout the universe.

"For all we know an intelligent inhabitant of the moon might feel the same way about us. He might argue that because he and his fellows needed no atmosphere as we know it, needed what to us would be inconceivable cold, intelligent life was impossible on our planet because of its envelope of atmosphere, which would smother such life with its comparatively terrific heat. Why, considered it all, man, an inhabitant of Mercury, or even of the sun, might argue that our old earth is dead and cold, compared to his abode, as the moon appears dead and cold to us. Or, vice versa, beings—intelligences—upon one of the cold planets might regard the earth as an uninhabitable glowing mass in comparison with the conditions he would require for existence. You smiled. Very well. Let me tell you some actual facts.

"An ordinary fly—any ordinary insect, even microbes or germs, as well as plant life—the instantly if immersed in boiling water. Can we leap to the conclusion that no life, plant or animal, can exist in boiling water? Not a bit of it. In the West Indies, in various parts of our world, there are insect larvae, as well as plants, that not only exist in but actually require boiling water. I myself have seen bubbling, boiling, steaming, sulphur-imprugated pools and geyzers fairly swarming with insect larvae and filled with water plants. To them, water of normal temperature would be as cold as ice water or solid ice to everyday forms of aquatic life. Take the other extreme. We have insects—a dozen species at least—as well as plants, that exist, thrive in snow, and that shrivel and die if exposed to temperatures above freezing. And if one form of life can dwell in boiling water, and another requires freezing temperatures right here on earth, what right have we to assume that nature—the Creator—did not people the planets with forms of intelligent life adapted to the conditions there? I—"

BUT you forget that here on earth we have atmosphere—oxygen, nitrogen, water—regardless of the temperature, whereas—"

"Whereas," he burst in, "on the moon there is no air, no water. Piffle! Because we—because earthly forms of life—need certain combinations of certain elements, you argue that there can be no life, no intelligence without them. Just as well argue that because man, horses—any land animals—must have air, there cannot be life in the sea, or because fish die when taken from the water, no life can exist on land. No, no, my friend, the trouble is man is such a damnably self-centered, egotistical, self-sufficient creature that he cannot—save in rare instances—conceive of anything, no, not of any condition, that is totally foreign, in complete opposition to his own surroundings and existence. Why, man alive, he—you—no man can visualize or imagine an intelligent being totally, absolutely unlike anything we ever have seen. Take stories of interplanetary travel for example, did you ever read such a story? Did you ever see a picture illustrating such a story—wherein the author—even Wells or Verne—described or pictured the inhabitants of another planet as wholly unlike anything on earth? Of course not. Always there is something familiar about them. They are semi-human or semi-mechanical or semi-bestial, or a combination of all, but never an entirely new and distinct creation. It is impossible that they

should be. So I maintain that all the planets—even the stars—are inhabited, and I still adhere to my belief that these areas of Eternism are produced by the intelligences on some other planet."

"For what purpose?" I asked, unable and unwilling to prolong the argument. "Do you mean you believe they are produced in order to injure us here?"

"How should I know?" he ejaculated. "Very possibly. But on the other hand, they may merely be the result of accident—the result of activities on the other planet. Very possibly the force—Eternism—is of vital importance to the inhabitants up there. Very possibly they have been using it for inconceivable periods—drawing it, extracting it from the space or from the other planets, just as we humans extract minerals from the air."

"Something like boring for oil," I suggested.

Sir Esme nodded. "A rather far-fetched simile and yet excellent," he said.

I laughed at a rather quiet conceit that occurred to me. "Your theoretical Martians or Venusians or Mercurians, or whoever they are, must have been awfully surprised if one of their gushers brought up human beings or ships or planes," I remarked.

"Do you know," he said, speaking quite seriously, "I've had that same idea in my mind—though not exactly as it occurred to you. I have been wondering if it is not possible that that is exactly what has occurred. But not by chance. If the beings who are responsible for these phenomena did not produce them with the purpose of securing specimens from our planet—or, well—something after the manner in which we dredge strange specimens from the depths of the sea."

"Surely," I cried, "you are joking. Even if it were possible for an object from the earth to be hurled, so, lifted, to the nearest planet, it would require years, ages, for it to travel such a distance."

"You forget," he reminded me, "that time is non-existent in space. Today here may be a thousand—ten thousand—years in the past or the future on another planet. For that matter, if you were to be hurled through space on an interplanetary trip, you could not possibly tell whether your journey lasted ten minutes or ten centuries, if it were not that your body, your organs, accustomed to food and sleep at definite intervals, would warn you of the passage of what we call time."

I threw up my hands in despair. "It's all quite beyond me," I declared. "I can never grasp these relativity and fourth dimensional ideas. Let's get back to earth. What, in every-day language, do you hope to accomplish by your cruise? What is your purpose? Even if you find the fabled things, what are you going to do about them?"

"My purposes are manifold," he replied. "First—tapping them off with his fingers, "I hope to prove beyond discussion that the areas of Eternism, or non-existent gravitation, actually exist. Second: I hope to learn something of the laws that govern them; whether they are, as I assume, confined to certain localities; whether they are permanent or transient; whether they move about on defined-courses or whether they merely occur in sequences along such routes. Third: I wish, if possible, to determine—at least to my own satisfaction—whether they are natural or are artificially produced. Fourth: If they are responsible for all the mysterious occurrences attributed to them. And finally—if I succeed in my other aims—I hope to be able to evolve some

means by which they may be avoided, nullified or offset. I may be wholly unsuccessful, of course. I may not be fortunate enough to locate one of the areas."

"Or unfortunate enough," I suggested. "But aren't you undertaking a terrific lot of trouble to check-trust such phenomena?"

"Possibly," he admitted. "But by study and observation man has learned to minimize the dangers of earthquakes and hurricanes, even though he has not been able to prevent them. If I could learn the laws, the actual facts regarding these areas, why mightn't it be possible to prophesy where and when they are likely to occur and thus enable others to avoid them?"

"That," said I, "sounds like the most sensible and comprehensible idea you have propounded. Admitting the existence of the areas—and I must confess I am beginning to believe in them, even if I can't quite swallow the idea of their being produced with malice aforethought by beings on another sphere—the common sense thing would be to learn all that is possible regarding them. Do you know I'm beginning to—well, almost to hope we do run across one of the devilish things."

CHAPTER VII

Caught in a Vortex

WHEN I boarded the *Lock Lorens* for that memorable voyage that was destined to end in such an amazing and incredible manner, I found that the yacht had been completely transformed. She had become a most luxuriously appointed craft, a floating palace almost, provided with every device and accessory for amusement, comfort and whiling away idle hours and days. But now I found her—although outwardly no different than before—stripped of all superficial fittings, a floating laboratory in fact, and equipped with scientific instruments utterly bewildering to me and that must have cost Sir Esme a fortune. Sir Esme was not one to do anything by halves. Once he had merged his personality and his life with that of the furious Alexander Macdonald, nothing, it appeared, mattered, aside from this one obsession to learn all it was humanly possible to learn in regard to his suppositions as to the existence of Eternism. I say suppositions, for while I had become a convert to the theory in a way, and regarded the existence of Eternism as proven beyond question, still I did not feel that there was as yet any proof of the actual existence of the areas Sir Esme was about to hunt for.

And I am free to confess that, had I been convinced of their existence—or had I dreamed there was the remotest chance of our locating them—I most assuredly would not have accompanied Sir Esme on his remarkable sea—as I considered it at the time—Quintic cruise. Not that I consider myself less courageous than the average man, and certainly not because I overvalue my life or go out of my way to avoid risks. On the contrary I have always been something of a fanatic, and in my years spent in wild and savage places risks had been so much a part of the day's work as meals or sleep. But it requires something more than mere physical courage to face some unknown, mysterious, almost unendurable and supernatural danger, and few men, I believe—and I know personally I would not—would knowingly rub elbows with a tornado or a water-spout merely in order to study its habits or idiosyncrasies. And if Sir Esme's sea-

gravitational areas existed, they were a thousand times more dangerous, more uncertain and yet, more arbitrary, than any tornado or water-spout that ever existed.

Sir Euseb, however, although absolutely convinced of their actuality, possessed the true scientist's sublime courage when it came to delving into the mysteries of the unknown. And his one consuming desire was to locate one or more of the areas.

Oddly enough, too, he had no assistants—if I except Harvey—although knowing him and knowing the egotism of all great scientists, it was not so strange after all. Frankly—and I have had no inconsiderable experience with them—I have yet to meet the true scientist who is not unreasonably jealous, suspicious and fearful of some one appropriating his ideas or discoveries. They guard their work and their experiments as if they were the most precious and coveted riches, and yet, in the end, give them to the public without recompense. And in Sir Euseb's case there was another reason. Like many men he was extremely sensitive to ridicule. He would take my humorous observations, my flippant treatment of his theories and reasonings in good part because he regarded me as more or less of a fool; because I made no claim to being a scientist. And yet, at times, I quite innocently and unconsciously wounded his feeling by my attitude. And I am quite certain that had he been ridiculed or scoffed at by a real scientist, it would have been more than he could have endured. Moreover, he had Harvey, and Harvey was more than an assistant, more a co-worker, I might say, quite efficient scientific to his fingertips, ever suggesting and aiding.

For the first few days after we left port the two were busy arranging and adjusting their instruments and equipments, testing them, unpacking cases and putting everything in readiness for use, while I—being passionately fond of the sea—enjoyed the ship and trip as I had promised Sir Euseb I would; enjoyed his cigars and his liquors and enjoyed the excellent means, for Sir Euseb's mania for science did not extend so far as to interfere with his fondness for good living. Though the yacht had been stripped of non-essential luxuries in fittings, no changes had been made in the steward's department.

To be sure, I offered to aid him and Harvey with the scientific stuff, but my offer was politely declined. So, having nothing better to do, I passed the time, as the *Lock Leaves* sailed steadily towards the Canaries, in keeping a journal of the voyage and in writing—while it was still fresh in my mind—a brief account of the incidents and events that had transpired—a work which has formed the foundation for the present narrative.

Until we sighted Tenerife the cruise was without any particular interest—nothing unusual occurred and, somewhat to my surprise, Sir Euseb did not as far as I know make any attempts to locate the areas for which he was in search. But on the seventh day out he had the yacht stopped and throughout the day he busied himself amid his instruments. I saw little of him except at meal times, when he informed me that we were on or near the verge of one of the localities where the phenomena might be expected. "But in his obvious disappointment and somewhat to my relief, nothing came of it and we again began to cruise.

It was on the ninth day that, seated on the after-deck smoking and lazily watching the searing man-of-war birds, the sky suddenly was blotted out by a dense cloud of smoke that poured from a row of pipes that pro-

jected from the deck-houses. Almost instantly the vessel was enveloped in almost total darkness and at the same instant I felt a distinct shock, a shudder of the vessel, as if she had struck some bit of floating wreckage, or perhaps better, as if she had been proceeding under power and her engines had suddenly been reversed.

Instantly realization came to me. The smoke could mean but one thing; that Sir Euseb had detected the presence of one of his Hæmionic areas and was attempting to safeguard the yacht and those upon her by means of his smoke-screen. And as I realized this a strange gripping fear came over me. I felt cold shivers chasing up and down my spine and I sat tense, every nerve strained and on edge, waiting I knew not what.

It is difficult to describe my sensations, difficult to put into cold print the feelings that raced through my brain as I sat there in that semi-darkness upon the yacht's deck with the heavy smoke-pall blotting out sea, sky, even the masts above me; in a silence that seemed uneasy, and knowing that close at hand, perhaps hovering over my head, was the strange, mysterious, incredible vortex that might at any instant sweep the ship with all on board into space. I felt like one who, having scoffed at ghosts, is suddenly confronted by one. It was more than fear, more than ordinary terror of something tangible. I had not believed in the things; I had not admitted—even to myself—that they actually existed, and I had not for a moment expected Sir Euseb to succeed in his quest. And now, though it outraged common sense, though my mind could not fully grasp the actuality, the impossible had occurred and we were in the presence of the mysterious, invisible phenomenon. I felt, I know, that everything depended upon the smoke-screen and yet I could not feel sure that it could be relied upon. It was all guesswork, all experiment, and I mentally cursed myself for being such a fool to have taken part in such a hare-brained, mad undertaking.

ALL this flashed through my consciousness in an instant. The next moment I had leaped up and was dashing headlong through the twilight obscurity towards Sir Euseb's laboratory. But I checked myself in time. Even in my excitement I realized that to burst in upon him, to interrupt him at his work might result in disaster. Yet I was mad, filled with an overpowering desire to learn the truth, to know what was taking place. How long I stood there white-faced, trembling, striving to force myself to be calm, I cannot say. It seemed hours, yet it could not have been more than minutes. I was brought to my senses by a burst of sunlight, by seeing the pall of smoke vanish, and the next moment Sir Euseb appeared. Never had I seen him so excited, so loyed up. Yet his face was radiant, his eyes fairly sparkled. Triumph was in his voice as he spoke.

"Congratulations!" he cried. "I was right! The areas exist! And the smoke counteracts them, destroys them! Did I—?"

"Thank God!" I exclaimed fervently. "But—"

"Everything worked out exactly as I had surmised, as I had deduced," he continued, heedless of my interruption. "Did you feel the shock—the lift of the ship? It was marvelous! According to my instruments the entire vessel was lifted—drawn up nearly two inches before the smoke-screen became efficient. Think of it, my friend! And yet it was a comparatively small area and we were not at the exact apex. And"—with a moan of

real regret in his tones—"it was completely despoiled by the smoke. What a pity! How can I study the phenomena if I am forced to avoid disaster by using smoke and when, by using smoke, I destroy the phenomena?"

"Darned if I know!" I ejaculated. "But thank Heaven the confounded thing *was* destroyed. It was bad enough as it was. And if that was a weak one, may the Lord keep us away from a strong one. And yet—yet now it is over, I can't really believe it. I—"

"Believe it or not, it's a fact," he assured me. "And best of all it proves I was right about the localities where the auras exist. Do you know we are in almost the precise spot where I instinctively placed the *Marie Celeste* at the time her company vanished?"

I gasped. The calm manner in which he made the announcement was simply amazing, and, unconsciously, I cast anxious, half-terrified glances at the sparkling sea, as if expecting to see some visible manifestations of the phenomenon.

"For heaven's sake, let's get away from here," I cried. "You've proved your case, you've learned how to counteract the effects of the uneasy things. What more do you want?"

He laughed. "I've only begun," he declared. "I must learn if this was mere chance, if there are others, if they are constant, and I must investigate conditions in other localities—in the vicinity of the spot where the *Kilwa-kwe* was first reported, in that area where so many airplanes have vanished. I—"

"Look here," I interrupted. "You're talking a great deal, Sir Esme. Suppose you run across one of the things at night, or when you were not prepared to throw off the smoke-screen. Why, before you could say 'loo!' we would all be done for forever. It's deadly hard for me to believe the things exist and yet I'm convinced there's something out here, some uneasy, mysterious business going on. And I admit I don't like the idea of monkeying with it. And how about your crew—what do they think of this matter? Sailors are usually a superstitious lot. Aren't they scared?"

"Why should they be?" he countered. "Captain Isbiter has perfect confidence in me, and I warned him before starting that we might experience some rather disturbing occurrences. But of course I have not attempted to explain what they really are. He and the crew imagine it all a matter of scientific experiments—meteorological, in fact—and to their minds the slight jar they felt was produced by me. Besides," he chuckled at the idea—"they have confidence in me. No doubt they argue that I must value my life and safety, and so there can be no danger. And anyway, they're all Scots and—I can say it without undue egotism—old fishermen who regard their kind as little less than divine. They'd follow me into Hell without a question."

There is no use in repeating all the conversation, all the arguments I employed as my endeavor to induce Sir Esme to abandon his, to my mind, mad and suicidal intentions. He was obsessed with the idea, his first experience—which I hoped and prayed was mere chance and would never be repeated—had merely whetted his desire for more, and when he finally lost his patience and sarcastically offered to set me adrift if I feared to go on, I returned that if he imagined I possessed less courage than he, Harvey or his Scotch seamen, he was vastly mistaken, and if he was bound to commit suicide and lose his ship or be whisked off into space by tempting

Fate and fooling with things he didn't know anything about, he'd find me making an ass of myself along with him. Then, suddenly realizing that we'd both lost our tempers and had acted childishly, we grinned, had a drink, told each other we were damned fools, and, once more as friendly and agreeable as ever continued on the cruise.

Whether Sir Esme's calculations and deductions were at fault, whether the auras were re-entrants, whether by chance we missed them, I cannot say, but days passed and despite his constant application, his constant observations and tests, Sir Esme was unable to locate a second *Renaissance* disturbance. We cruised back and forth, sailed in wide circles, drifted idly over a glassy sea, passed and repassed the headlands where, according to Sir Esme's deductions, the phenomena should be most numerous, but there was no trace of them. It began to look as if our first experience was to be the only one, and I am sure that Sir Esme himself was becoming discouraged and I could not blame him. He had made a great, a monumental discovery; he had evolved an elaborate, an amazing hypothesis; he had devoted years of research and a fortune to his efforts, and now, after all his preparations, his hopes and his optimistic expectations, he had found only one of the strange *Renaissance* auras and had been unable to study it or to learn anything of value in regard to it. No, I should not say that, for as I told him, I felt that he had learned the most valuable and important fact of all, namely that the dread things could be nullified, rendered perfectly harmless. He smiled when I called his attention to this fact.

"Quite true, to a certain extent," he agreed, "but absolutely valueless. You forget that, in order to make use of the smoke-screen, one must know when and where the phenomenon is about to occur. I, being constantly on watch and equipped with the most delicate of devices for detecting its presence, was thus enabled to use the smoke to advantage. But you will recall that, even so, I can't say my crew complete failure. What chance then would a ship or an airplane have? By the time the auras were detected it would be too late to nullify it. No ship has ever had time to send an SOS before being overwhelmed, much less an opportunity of producing a screen of smoke."

I had to admit he was right. As matters stood his discovery did not amount to anything as a safeguard.

Sir Esme possessed the proverbial British side-to-side-ness and it began to look as if the cruise might continue forever and the *Loch Leven* might become a second Flying Dutchman. We were in the doldrums at that time, and for day after day the ocean stretched as smooth as a sheet of burnished silver under a cloudless sky. It was beauty hot; time began to hang rather heavily on my hands, and I had become firmly convinced—in my own mind—that the supposed area of Esmemur we had met had been nothing but an atmospheric disturbance and that the things did not actually exist.

I had, in fact, returned to my original point of view. I thought what a superstitious fool I had been to have been terrified by an imaginary danger that unquestionably existed only in my friend's mind, and I was dead sick and tired of the whole fruitless search. I tried fishing, I dipped up buckets of the floating organisms and amused myself examining the strange crabs, fish and other marine creatures that inhabited it, and I searched the horizon until my eyes ached, hoping vainly for the

glimpse of a distant sail or smudge of smoke to tell me we were not the only ship afloat upon that vast, limitless expanse of sea.

It was while thus sweeping the horizon with my glasses one morning that I discerned a low dark object breaking the sea's rim. For a moment I thought it a whale. Then I decided it was a floating log. Yet it did not appear exactly like a water-logged tree and, my curiosity aroused, I hurried about for a better view. Then as I focussed my glasses upon the thing, I discovered it was a derelict, the almost submerged hull of some wrecked ship. Almost at the same instant the captain discovered it and verified my observations. There is always something strange, something exciting about sighting a derelict and soon all aboard the *Lock Lovers*, who were not otherwise engaged, had gathered on deck, their eyes fixed upon the distant wreck. Slowly we moved towards it; each minute it became nearer, clearer, and a couple of hours after I had first caught sight of the thing it was in plain view: the hull of a wooden vessel, with the jagged stumps of masts projecting above the decks that were almost awash, with shattered, splintered timbers, and so weather-beaten, so overgrown with seaweed that showed each time the hull rose or fell to the log, almost invisible swell, that it obviously had been floating about for a long time.

Something, some whim tempted me to visit the wreck, and Sir Esme ordered a boat lowered and manned, although he declined to join me, declaring that if he deserted his instruments it would be just like his lack to miss detecting the presence of one of his confidential areas. "Well, if one comes along, share it off from the derelict," I laughed as I jumped into the waiting boat. "You see, we haven't any smoke-screen devices on her."

As we pulled away I saw Sir Esme turn and enter the laboratory where Harvey had remained on duty, and I regretted having spoken so flippantly, for he looked a bit hurt and I knew how mortified he felt at the failure of his plans. But a moment later the boat was alongside the hull and with some difficulty, for everything was covered with slime and I dared not trust to the dangling remnants of rotted cordage, I managed to scramble to the deck. There really was nothing much to see. The decks, where not washed by the water, were white with the droppings of sea birds. The deck houses were crushed in as if by falling spars, and a glance within the remains of the cabin revealed only black, blanching water. But the hatches were still in place and I surmised that it must be the air within the hold that kept the wreck afloat. Now that I was upon the derelict all the lure of the unknown, all the fascination of the ocean wolf was lost, and I was on the point of calling to the men to bring the boat alongside when one of them called out that a portion of the wreck's name was still legible upon the stern.

"Can you make it out?" I asked, peering over the remains of the after-rail. "We ought to report her if we can find out what she is."

"Pretty well weathered, sir," he answered, "and only shows when she rolls a bit to 'er 'old. Looks to me like a foreign name, sir. Yes, sir, that's what 'is. Dago of some sort, sir. Run sort of name I'd say, begins with a S an' ends with a S, if—"

At that instant I felt a sudden rush of air. There was a peculiar gurgling, moaning sound from behind me.

Startled, fearing that the wreck was about to sink beneath me, I whirled, tense, ready to leap into the sea and swim for my life. As I did so, there was a sharp, terrified shout from the men: "Good, the *Lock Lovers*!"

But I had already seen. Never will I forget what my horrified eyes saw. I seemed frozen, glued to the spot, paralyzed. From beneath the yacht's keel a great column of water rose up. A foaming, whirling, roaring geyser. And upon its summit—rocking, pitching, spinning like a topstone was the *Lock Lovers*.

It was so terrible, so unreal, so uncanny, I could not believe my senses. I seemed in a nightmare, a ghastly dream. And it seemed all the more diabolical, all the more incredible and unreal because on every side the sea stretched calm, untroubled by the faintest breeze, and overhead the brilliant sun blazed down from a flawless sky of blue.

Up and up, faster and yet faster, rose the yacht, while below her the water boiled and roared like an inverted whirlpool. And then, between her keel and the molten steam below, my incredulous eyes saw vacant space. The *Lock Lovers* was floating in air! She was poised, gyrating madly, fully fifty feet above the sea, and with a trembling shock realization came to me. She was caught in one of the Fenshank vortices, she was being lifted, projected into space!

It had all happened in an instant—perhaps in the fraction of a second—yet to me it seemed minutes, hours, as I gazed, almost breath of my senses, at the yacht being lifted bodily into the air by that unseen terrible force.

Then suddenly yachts, sleek, that fearful ominous cone of swirling sea, scudded hithered out. Where a moment before they had been was a dense black cloud. Then to our ears came the sound of a rending crash. Waves came rushing seawards from the whirling, rolling cloud of black. The derelict tumbled sluggishly, the boat pitched and tossed, water hined across the decks about my feet. I gasped, caught my breath, seemed choking, as I watched, still incapable of movement, striving to penetrate that pall of blackness where the *Lock Lovers* had vanished. Yet my mind was working, my brain was functioning. I knew what had happened. Sir Esme had released his smoke-screen. The gravitation had been restored, the yacht had fallen back into the sea. But too late. The yacht crashing back from such a height must have been shattered, battered, and Sir Esme, Harvey and the others must have been killed.

Slowly the smoke thinned, drifting away. With a hoarse shout I came to life, leaped into the boat, shouted, swore at the men to bend to their oars. Frantically they pulled for the wrecked and shattered yacht that was sinking rapidly beneath the sea.

CHAPTER VIII

The Re-Establishment of Personalities

AS we reached the scene of the horrible disaster and the boat bumped against fragments of wreckage, the splintered remnants of the *Lock Lovers* vanished and only the filar of floating wood, a shattered boat, the deck fittings of the yacht and odds and ends of flotsam remained as evidences of the tragic fate of Sir Esme's ship.

Standing in the stern of the boat I searched among the wreckage for possible survivors, hoping against hope

that some one—Sir Esme, Harvey, members of the yacht's crew—might have escaped instant death. Within a dozen yards of the boat a body floated, and the next moment we were lifting the unconscious form of Harvey into our boat. I thanked Heaven that he still lived, and saw for an ugly gash across one cheek and a bruise on his forehead he seemed unharmed.

A moment later we were beside another body. The uniform identified it as Captain Ibbister, but the face and head were crushed beyond recognition. Two other dead and mangled bodies floated among the wreckage, and then, half-hidden in the tangled debris, we found Sir Esme. And so we lifted him gently I fervently thanked God, for he was alive and, though unconscious, appeared to have escaped unharmed. But we were in a desperate plight. We were afloat in a small boat in mid-Atlantic, burdened with two unconscious men, hundreds of miles from the nearest land, far out of the track of ships, and our only food and water were the meagre supplies with which the small boats were always provided. Yet I was so busy striving to restore Sir Esme and Harvey to consciousness that I scarcely realized the situation until the quartermaster in charge of the boat's crew spoke:

"Beggin' your pardon, sir," he said, "we're in a rum fix, with what the life of 'blest an' the keg of water aboard, sir. Maybe, sir, if I may be so bold as to suggest it, sir, we'd best have a look about an' see can we pick something from the wreckage, sir. And there's that other stove boat, sir. Maybe the blest an' water in her's all right, sir."

"Yes, by all means," I agreed, "but be quick about it. We must get Sir Esme and Harvey to the derelict. It's our only refuge for the present."

Luck was with us. Not only did we find the biscuit and water in the wrecked boat still intact, but among the debris we picked up a cask half full of water, a case of wine, a keg of ship's beef and an unopened box of cheese. There was no danger of dying of thirst or starvation for some time, and even as we rowed towards the derelict, I was forming vague plans for salvation.

Even the waterlogged derelict seemed welcome and safe, in comparison to the cockle-shell of a boat, and, having transferred Sir Esme and Harvey to the cleanest and driest portion of the deck we devoted all our efforts to reviving them. Both men evidently had been stunned and rendered unconscious before falling into the sea, a most fortunate thing, for they had drawn but little water into their lungs. Rubbing them, sleeping them, rolling them on the decks, forcing the welcome and providential wine down their throats, we worked at them. Harvey was the first to regain consciousness. He opened his eyes, took a deep breath, blinked and gazed about.

"What—what's happened?" he whispered. "Where am I? Where's Captain Mendoza? And who are you? I don't recognize you. How did you get here?"

Then, before I could reply, before I could recover from my astonishment at his failure to recognize me and my dread that he had received a blow that had deranged him, he continued, "Of course! Now I remember. The *Santa Juss* was wrecked, struck by some sort of a cyclone. But I thought—I must have imagined it—I was blown, sucked from her. But of course you picked me up. Where are the others? Who is the poor chap yonder?" He indicated Sir Esme.

I was so amazed that for a moment I could not speak.

He remembered he had been on the *Santa Juss*. His memory had returned. But how was it possible he did not know Sir Esme; that he did not know me or the quartermaster? Then, before I could frame a question, Sir Esme drew a deep breath, sighed, and opening his eyes, sat up with a jerk.

"Thank Heaven you've recovered!" I exclaimed. "I—"

"What the devil has happened?" he ejaculated. "What the devil am I doing here? Where's—"

"Don't you remember?" I asked anxiously, a numbing chill at my heart, for fear he had received some serious injury to his brain. "The yacht was wrecked—hurled into the air by one of the vortices. But thank God you used the smoke as time to save your life and that of Harvey. And you're on the derelict. I picked you both up. It—"

"Yacht! Wreck! Vortices!" he cried. "What the devil are you talking about? What do you mean by smoke? What derelict are you referring to?"

My worst fears, I felt, were borne out. Sir Esme was raving. He must be out of his head. But perhaps, I thought, it was merely the effects of shock, a temporary loss of memory.

"It will all come back to you in a short time," I assured him. "No wonder you cannot get your wits together or your memory working right away. It's the same with Harvey; he didn't recognize me at first. But thank God we are all safe for the present, though poor Ibbister and the rest are lost."

Sir Esme was reviving, his hoarse brows knit, obviously striving to recall the details of the catastrophe.

"I remember being on the yacht," he said at last, speaking slowly and as if voicing each detail as it returned to him. "And I recall that you were with me, and Harvey, of course. But what the devil we were doing, what happened, is all a blank. Sorry to hear old Ibbister's gone. I suppose we must have run into this hell, eh? Funny thing, that; he was a good stunner. Must have been in the right, I presume. But I can't grasp what you meant by the *Leak Lovers* being hurled into the air by some devilish thing you call a vortex, unless you mean we were lit by a water-spout. But what's to be done next? Can't stop here on a half-sunken wreck forever."

I shook my head. Sir Esme spoke rationally, surely, but evidently he could not recall the tragedy. And if—my thoughts were interrupted by Harvey who, having apparently regained nearly his normal strength, had been sitting up, staring with a puzzled expression at Sir Esme and myself.

"Pardon me, but are you Sir Esme McDonald?" he asked.

Sir Esme whirled. "What?" he exclaimed. "By God, are we all crazy? Of course I am. I might just as well ask you if you're Harvey."

"Well, I'm not," was the amazing reply. "Who's Harvey? I never heard of him. I'm Professor Archibald Himmiston of Langford. I recognized you from pictures I've seen and I am interested and glad to know you on account of your excellent article in the *Sportsman* on the preservation of wild game. I'm intensely interested in the subject. But what, may I ask, brought you here, Sir Esme? I was not aware that there was a vessel in sight when the *Santa Juss* ran into that terrific whirlwind. And now here you are with these other

strangers aboard; all that's left of the poor old *Santa Ana*! And if you wish to know what I was doing on a Spanish ship, I was returning from the Canaries, where my yacht had gone on the rocks."

Sir Esme's jaw gaped; he was gazing at the man we had known as Harvey as though he had been a ghost, and I, too, was staring at him, speechless with astonishment. The fellow's lost memory had been miraculously restored. He remembered who he was, where he had been when disaster overtook him, but—judging from his words—he could recall nothing that had occurred subsequent to the loss of the *Santa Ana*.

Sir Esme was the first to speak. "By Jove!" he cried, "either you're as crazy as a mad hatter or I am. You may be Professor Humiston—I'll admit you might be the King of Delaney or the President of Argentina, for all I know to the contrary. But to me you're Harvey, the chap I picked up drifting damn near drowned, off the West Indies. And do you mean to tell me you never met me before? Why, by God, you've been with me, my man, for—"

"You're mad!" the other burst out, cutting Sir Esme's sentence short. "Picked me up over by the Antilles. Me your valet! Hang it all, you may be Sir Esme McDonald, Baronet, but you're stark, staring mad if you say such things. Why, good Lord, man, here I am, still wet from my immersion, still on all that's left of the *Santa Ana*, and you have the monumental nerve to tell me that you picked me up a thousand miles from here. You—"

"Gentlemen, please, please wait a bit," I begged them, as I saw Sir Esme's face flushing with anger. "Let us try to explain."

As few words as possible I tried to make them understand. But it was hopeless to try to awaken their memories. Harvey—no, Professor Humiston had, by some freak of mind, perhaps through shock, perhaps through some strange, mysterious effect of the Esmanic area, been restored to full and complete memory of his life up to the time when the *Santa Ana* had met with disaster, which, I was now firmly convinced, had been caused by a non-gravitational vortex exactly as the Loch Lomond had been wrecked. But all subsequent events, his service with Sir Esme, his life as the mysterious Harvey, had all been wiped completely from his memory.

On the other hand, Sir Esme, through the same shock or the same effects of the force that had destroyed his yacht, had lost all memory of the events leading up to the disaster, and as I soon discovered he had not the faintest recollection of having discovered Esmanism, of having set out on a voyage to locate the Esmanic areas. More, and most amazing of all, he did not remember anything whatsoever about his scientific work. Science, scientific terms conveyed no meaning to him. We knew less of science or at least no more on the subject than did Hobson, the quartermaster. All the months, the years he had devoted to scientific work were a blank to him. His other personality, Alexander Macdonald, had ceased to exist even as a memory, and only Sir Esme remained.

INDEED, both he and Professor Humiston scoffed openly at my attempts to convince them of the truth. They both regarded me as having become mentally deranged from my experiences, and each looked upon the other as a bit mad and regarded himself as the only

really sane member of our shipwrecked party. Nevertheless they became good friends and presently ceased arguing and turned their attention to the more pressing and important matter of evolving some means of rescuing ourselves from our precarious position. Very probably we might all have succumbed to thirst, starvation or other causes had it not been for Hobson, who remembered the yacht's position when he had last been at the wheel. And being an unusually shrewd fellow for a common sailor, and with ambitions to become a navigator, he had noticed that the chart showed a group of small islands about two to three degrees south and a degree and a half west of our position. To attempt to traverse nearly two hundred miles of ocean in a small boat, whose only means of propulsion was oars, was a somewhat dangerous undertaking, not to mention the hardships it would entail. But with a seaworthy, well-built boat and in the calmest portion of the ocean, it was a far less hazardous matter than to remain upon a drifting derelict, that might never be sighted by a passing ship. Moreover, we had no choice in the matter.

That same night a long, slow swell came rolling out of the east, the waterlogged bulk rose and fell sluggishly, water washed over its all but submerged decks, and when dawn burst in a blaze of glory over the vast expanse of sea, we found that the derelict's haws were numbered. During the night she had settled appreciably. At any moment the hatches might give way and she would then plunge like a plummet to the bottom of the ocean. So, having breakfasted on crackers, cheese and wine, we clambered into the small boat and pushed off from the pathetic bulk that, within the next few hours, would vanish forever.

And we were not a moment too soon. Scarcely were we clear of the wreck when there was a roaring, tearing explosion; fragments of timbers and hatch covers flew high in air, water poured in torrents over the rest decks and into the yawning hold, and suddenly lifting her stern in air she plunged beneath the waves. But in that moment that her battered counter had been raised clear of the sea, her name, painted amid ornate scrolls across her stern, had been revealed, and with marvellous eyes I had read: "*Santa Ana, Barcelona!*" It seemed impossible, incredible, utterly beyond belief. Harvey—no, Professor Humiston—had been right!

By some freak of fate he, we, had found refuge upon the bulk of the ship from which he had been cast into the sea. Of course he didn't appear in the least surprised, for he was utterly unaware that nearly two years had passed since the *Santa Ana* had been left, a battered, helpless wreck, by the phenomenon that had destroyed her and had carried her—yes, I was forced to believe it—hundreds of miles across the ocean. The Lord only knows what the effect might have been had Sir Esme read the derelict's name, but fortunately his head was turned at the time and it escaped him. But as he recalled nothing of his theories and merely knew he had rescued Professor Humiston from the sea in a distant part of the ocean, it is probably the revelation of the derelict's name would merely have confirmed his belief in Harvey's—no, the Professor's—mental delusions.

There is little more to tell. In due time we reached the islands, little the worse for our long, hazardous and uncomfortable voyage. They were uninhabited, unvisited, rocky islets, but with some vegetation, the houses

(Continued on page 253)

Element

ONE of the greatest losses in the World War was the death of the young and brilliant Moseley at Gallipoli. He arranged a number of metals in a series, which has since been expanded to include all elements, so that each one has its atomic number; the lowest, hydrogen, having one and the highest, uranium, having 92, giving a new view of atomic relations. The many gaps which existed in the series have been gradually filled by the discovery of previously unknown elements. The possibilities which the yet unknown elements may hold may be many and inconceivably great. Who knows, then, but that our new author has hit on a good bit of truth in his "Element 87," six places below uranium, the highest in the scale? And it may be that we will know sooner than we expect.

Illustrated by MOREY

I LANDED from the steamer, got my trunks through the customs and on their way; then I hurried uptown and had a little dinner with my old friend, Harrington. After that I went home to my apartment. It was just the sort of an evening for a visit from von Hofen. The sun had gone down in one of those ghostly green sunsets that always give me the creeps. Now it had begun to rain; a slow, dreary drizzle, accompanied by a whining wind, that suggested the gibbering of ghosts and all that sort of thing.

You may wonder why all this suggested a visit from von Hofen; but you don't know von Hofen. He is the finest old scout that ever lived, and I haven't a better friend in the world; but, long as he isn't human. He won't be offended when he reads this. I have told him the same thing hundreds of times; and he only laughs and says, "Ach, so!" I am an scientist; I'm just a plain money grubber; and the things that von Hofen does with induction coils and cathode rays and things of that sort seem to me positively uncanny. I cannot rid myself of the feeling that there is something diabolical about it all.

I am not ashamed of being a money grubber. Somebody has to be that, or the von Hofens could never put their mess across; and I am proud to say that my dollars, backing up von Hofen's brains, have contributed much to the pleasure and comfort of mankind.

I went to my book-case for something to read. The first thing I got hold of was "She." It was just the sort of an evening for Rider Haggard; so I put that back. The next was a volume of Poe's tales, and it fell open at "The Masque of the Red Death." Nice reading for such a night. I put that back, too. I needed a sedative, and was looking for Carlyle's "French Revolution," which always puts me to sleep, when the bell rang. It was von Hofen, of course.

"Well, you old wizard," I said, "what is it this time, and how much is it going to cost?"

"Ach," said he, "I have the so wonderful idea. It will shake the world. Radio? Television? Bah! They are as nothing. I have already in the laboratory the oh so small model. It works; but ach, how it has cost. My

car, my house, and"—here he glanced down at his vest—"yes, I have, as you say, 'hook' my watch."

"Your car, your house, your watch!" I shouted.

"Yes," he replied calmly; "but it is not enough; so I have come to you as soon as I hear the steamer is arrived."

"But why didn't you come to me before?" I stormed.

"Ach, but you were in Europe. I could not wait to try out this so wonderful invention."

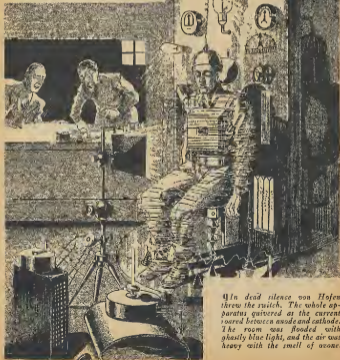
"But," I persisted, "why didn't you write or cable or radio or something? But you are a genius—an inventor; and of course you couldn't be expected to have a grain of ordinary common sense. Come on; let's go have a look at your contraption."

My car was still in storage; but I called a taxi, which soon dropped us at a dingy lounge over on Second Avenue. We descended the area steps. Von Hofen unlocked the gridded iron gate and then the door leading into the basement hall. He lighted the gas, and unlocked a third door, opening into the underground room which was von Hofen's laboratory. Here he proudly displayed the working model of his latest invention. To me it was only a conglomeration of batteries, wires, glass tubes and coils; but von Hofen entered upon a lengthy explanation, which I give here, as well as I can, in the hope that it may mean more to some of you readers than it did to me.

"I have discovered the great secret," said von Hofen, "for which, a long time, the scientists have searched. All matter, as you know, is made up of atoms. These atoms, they are composed of electrons and protons. But what are these? Ah! that no one knows but von Hofen. I have prove that they are nothing but vibrations. I have discover, too, that each element has its own vibration—its own wave length—and that these follow the scale of atomic weights and the X-ray spectrum of the so great Moseley, from hydrogen, which is number one, to uranium, which is number ninety-two. A compound, too, is but one vibration; made up of many, yes; but only one. Ach, how shall you understand? But listen. You hear a great orchestra; a hundred pieces; brass, wood-wind, strings, each with many sound vibrations,

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By Ralph Linn



In dead silence von Hofen threw the switch. The whole apparatus quivered as the current soared between anode and cathode. The room was flooded with ghostly blue light, and the air was heavy with the smell of ozone.

many overtones. Many thousand vibrations of sound, you would say. But no. There is but one. It can all be contained in the so small groove of your phonograph disc. You start the record, and, in this one vibration, you hear upon all the instruments. It is the same with the telephone, the radio, with this so wonderful invention of mine. Many vibrations, and yet but one. A playing record, is it not so? Though a compound should contain all the elements—there can be but ninety-two—it matters not. It is not ninety-two vibrations, but only one.

When any so great invention I have complete, there will be a screen with ninety-two—what shall I say? Lenses? Each lens shall take up the vibration of one element. Good. I place in the sending chamber, let us say, the box of candy which you wish to send to your sweetheart, and turn on the current. Each element is taken up by its own lens on the screen, and passes into the condensing globe, where all are focused into one ray. This ray shall fall upon a reversing screen at the receiving station, and all parts shall be reassembled to the same form as before. Shall you wish to go again to Europe, you shall not take the steamer. No. You shall sit in the little chair in the sending chamber; then I aim the machine to, shall we say London? I turn it until the little needle on the dial shall point to the London mark. If it is not point correctly the switch will not close. I turn on the current, and poof! you are sitting in the little chair before the receiving screen in London.

"But I have not put the screen. I, as you say, want broke. For the screen one must have a substance which is radioactive. In this so small model I have use radium. It has but the one lens, which will send but one element, iron. See, here is a ball of pure iron. I place it here in the sending chamber, and close the switch. The vibration of iron passes through this tube here into this glass globe, which is the condenser, and sends the vibrations in one beam—in one direction; else there would be no more iron, but only vibrations, spreading abroad through the ether like rings in a pool into which you have throw a stone. Now see."

He closed the switch. There was a burning noise, and the glass tubes lit up with blue light.

"Now," said he, shutting off the current, "you shall find the little ball of iron before that screen on the other side of the room."

It was there, sure enough.

Von Hofen laughed in triumph. "But it will do something more; something that will be of the greatest use to the chemist. How big ball. It is not iron; it is steel. It contains carbon. I place it in the machine, and close the switch. See. The iron goes to the screen but the carbon is still here in the sending chamber. So you see this so wonderful machine can be use to analyse any compound, no matter how complex, by using one lens at a time until all the ninety-two shall have been tried. It can also, in the same way, produce any element pure and without adulteration."

HERE von Hofen began a technical explanation of just how the apparatus worked; forgetting entirely that he was speaking to one with only the most rudimentary knowledge of science, all of which was so utterly Greek to me that I cannot remember a word of it.

The money now being available to supply needed materials, von Hofen worked like a slave, day in and day out, rapidly extending the scope of his operations. From

iron he turned to other elements, and then to simple compounds, advancing rapidly to those which were more complex. He was wild with delight when he succeeded in sending a block of wood across the room, proving that so-called organic matter was not beyond the power of his machine to handle. Then came the wonderful day when he succeeded in sending a dead cat across the laboratory. Having accomplished this, he was ready for the greatest step in the development of the invention: the step from dead and inert materials to the living creature.

After several days of careful adjustment of the apparatus, he believed that everything was in shape; and insisted upon my being present at this crucial test. A living cat was placed in the sending chamber, and the current turned on. I confess that I felt much like a schoolboy speaking a piece and suffering from stage fright. Von Hofen's hand trembled so that he could hardly close the switch. Unfortunately for the cat, the experiment was not a complete success; the instrument being evidently in need of further adjustment. The animal arrived at the receiving screen in apparently excellent shape, except that it was dead. During the next week the mortality rate among the cats in the neighborhood rose alarmingly; but, just seven days after the first experiment, the cat, a big Maine, as I remember, was found at the receiving end, contentedly purring, and apparently unaware that anything unusual had happened to her.

The next step was to rent a room in a shabby building in the neighborhood called "Hof's Kitchen." This place had formerly been occupied as a gambling den. It was lined with sheet iron; its heavy door was also reinforced with iron, and defended by huge locks. Here we installed an immense receiving screen, and experimented with sending various objects across the city. This ten-story neighborhood was chosen for the double reason that it was a desirable distance from the sending station and was, moreover, in a section where strange actions were unlikely to attract much attention from anyone except, possibly, the police. The fortified room, moreover, rendered it less likely that inquisitive persons would force their way into the place, with consequent damage to delicate apparatus costing many thousands of dollars to install.

The fabrication of this series of experiments brought, incidentally, one of the greatest sensations which the city had known for a long time. By means of bank note diplomacy, securing the cognizance of the janitor of a certain medical school, we arranged to borrow a dead man from the pickling vat, plunging ourselves to return the same when we had done with it. That was a ghastly piece of work. Approaching the building at a rear entrance, and giving a preconcerted signal, we were admitted by our dusky co-conspirator of the dissecting room, where he was roused at the time of our arrival, in the pleasant task of gathering up such fragments of human remains as were no longer of use, to be burned in an incinerator in the basement. All about, stretched on slabs, were awful shapes that made my flesh creep. Some were covered, some were not; some were entire, some decidedly not. I felt like a ghost. From the vat at the rear of this cheerless place a prospective subject was fished, with the assistance of the janitor, bundled up, and conveyed to the car waiting by the door, taking advantage of the time between the rounds of the pathman on the beat. With our unpleasant passenger we sped to the basement laboratory on Second Avenue, smuggled it in, and placed it in the sending chamber of

the full-sized machine which had now taken the place of the little working model of a few months before.

The whole experience was as weird, so smacking of witchcraft, sorcery and that sort of thing, that to this day I get goose flesh when I think about it. We placed the dead man in the chair, securing him in a sitting position by means of bits of bristled wire that lay scattered about the place. I can see him now, that grisly dead man, sitting in that chair, surrounded by tubes, coils and all sorts of mysterious apparatus. His sunken eyes were open, staring. Von Hofen seemed, if possible, even more nervous than I. I remember that when either of us spoke, which was not often, it was in a whisper, or in such low tones, as one might use in addressing a fellow mourner at a funeral. Nets and powerful induction coils had been provided, and current at a high voltage had displaced the 110 volts of former experiments.

Von Hofen went over the entire machine; tightening a binding screw here, adjusting something there. I feel pretty certain that all this was done for the purpose of delaying the crucial moment until he could get control of his nerves, then for any other reason. All was ready. In dead silence von Hofen threw the switch. The whole apparatus quivered as the current roared between anode and cathode; the room was flooded with ghastly bluish light, and the air was heavy with the smell of ozone. While von Hofen's hand was still clung to the switch, the sending chamber was empty.

Von Hofen jerked upon the switch, and we rushed from the room to the street, never stopping to turn out the light, and slamming doors behind us as we went. I heard the clang of the iron gate as I reached the top of the area steps. We leaped into the waiting car and sped, in defiance of the traffic laws, I fear, to the house on Tenth Avenue. Up the stairway we raced, as though the police were after us. Von Hofen's hands shook so that he could hardly get the key into the lock. We flung the door open and stepped on the light. A horrible sight met our eyes. The body was there; but in a condition which it would be idle even to attempt to describe. "Scrambled" is the only word that I can think of which can even faintly suggest it. The features were grotesquely misplaced, as were the arms and legs; but this was not the worst. The entire structure had been dulled, so to speak. I have no doubt that a microscopic examination would have shown that not a cell of the entire organism had retained its proper shape and position. The result was something which had certainly never been seen before in the history of the world. I cannot even hint at its appearance.

As we had promised to return the body to the pickling vat, there was nothing to do but to bundle up the thing and struggle it back to the medical school, get it into the vat without anyone having seen it, and leave future events to take care of themselves. We managed to accomplish this without permitting our janitor friend to look at the gruesome object; when, therefore, it should turn up in the dissection room, there would be nothing to connect it with the subject we had bereaved.

A few days later the creature was fished from the vat and placed upon a slab, and then the fireworks began. The medicine declared that it was utterly impossible that such a being could have survived to reach maturity, but since it was, so to be accounted for. No one knew whence it had come, and every effort to trace it back to its source, so to speak, resulted in failure. The morgue emphatically denied all knowledge of it. A storm of discussion arose.

Physicians and surgeons from all parts of the country flocked to suspect it, and add their conjectures to the mass of conflicting opinion. A noted chemist offered the suggestion that the astounding condition observed had been caused, in some manner, by the liquid in the pickling vat, but, as the other subjects in the vat showed no signs of distortion, this theory was not generally accepted.

The newspapers devoted their front pages to the marred details. One Sunday Edition contained a whole page of pseudo-scientific baloney, with blood curdling illustrations, greatly discussing the probability of the creature's having come on a tin-can or from Mars. Then a millionaire cloped with his stenographer, the front page and the public turned their attention to that, and the incident was forgotten; except by a few medical men, who, no doubt, are still puzzling over it.

For the first time in all my acquaintance with him, I found von Hofen dejected and discouraged.

"I can do no more," said he. "The screen must be radioactive. I have used radium; but it is—how shall I express it? too coarse. There is no known element that can take its place. There is one, number eighty-seven in the scale. It comes next to radium in the periodic table. That, I am sure, would do; but it has never been discovered. There is only one man in all the world whom I could depend upon to find it for us. He is the greatest of all chemists. Fame, wealth, what you will, might be his; but he has the evil heart. He is even now in prison."

"Prison doors can be opened," I said. "I will stop short of nothing but murder to put this thing across. Who is he? Where is he?"

He was, it seemed, one Professor John Carson, whose residence at the time was one of those neat and compact folk apartments up in Coaling prison.

Now I am a normally law-abiding citizen; but, in this instance, it appeared to me that the success of von Hofen's invention was of such immense importance to mankind as to justify a certain waiver of legal technicalities, so long as nobody was actually harmed thereby, if such should be necessary. Here was evidently a case where back-sit diplomacy was again called for. By such diplomatic means, therefore, I secured the cooperation of a barefoot or two. When that had been accomplished, the rest was comparatively easy.

I HAD a long interview with Professor Carson, in which I made cryptic propositions to him, which he accepted with alacrity. At the same time I took careful note of his personal appearance, manner of speech, size and approximate weight, as they appeared to me from personal observation. I also secured exact data on these points, together with a photograph, from the prison files. The next thing was to find a man answering as closely as possible to the general description of Carson, whose financial status was such as to render it worth his while to do two years' "time" for a few thousand dollars. This required a little delay, but the man was finally found.

This man was admitted to Carson's cell, where they exchanged clothing. At the end of the cell, Carson walked out, unaccompanied, leaving his visitor to serve the balance of his term. Carson was given clearly to understand that his freedom was only to last as long as he played square with us; and that, at the first sign of crooked work, means would be found for getting him once more behind the bars.

These little details having been attended to, a fully equipped laboratory was provided for the use of our chemist, at my expense. As I watched him at work, I felt rather proud to be the owner of all that collection of furnaces, heaters, retorts and crucible glassware, even though I had no romantic notion what any of it was for.

In the matter of zeal, Carson left nothing to be desired. He was in his element, scrupulously fascinated by his task; and he threw himself heart and soul into his work, which he loved better than anything else on earth—except crime. On one occasion, at least, he remained for a full twenty-four hours in the laboratory, fascinated by some experiment which he was conducting, never leaving it to eat or sleep. And then, one day, he came into the basement room on Second Avenue, with a beaker containing a handful of something that resembled coal robes more than anything else I can think of.

"Here," said he, "is a concentrate containing the substance we are looking for. From its position in the Periodic Table, I was convinced that it would be found in one of the radioactive areas, accompanied by, and possibly overshadowed, by radium. Yesterday I found unmistakable traces of it, and by working all last night I finally obtained this. I could, no doubt, separate the element in my laboratory, but, with the aid of von Hofen here, I think we can save considerable time. In the corner over there is a small model of the projector, which, I understand, has but one lens, as von Hofen calls it, tuned for iron. If von Hofen will provide us with a small lens tuned for the purpose, we can separate out the element we desire more quickly, and probably in a purer state than I could obtain it in my laboratory."

In a few hours the desired screen was at hand. The concentrate was placed in the sending chamber of the little projector, and the small receiving screen was set up in its old place at the end of the room. When the switch was closed, I could observe no difference in the appearance of the concentrate; but, on the little tray before the receiving screen, was scattered a greyish powder. Perhaps a teaspoonful altogether.

"Don't touch it," warned Carson. "It is not as destructive as radium, I am certain; but I shouldn't care to handle it with bare hands until we know more about it." He poured the powder into a small leaden phial, which he held out toward us with a dramatic gesture.

"Here it is," he said, "Element Number 87, discovered by me, John Carson, and which I have taken the liberty of naming after myself, 'Carsonian'; and here"—producing a small note-book—"is the formula."

"Carsonian," to our great delight, proved to be all that we had hoped for. The invention was a success. Now came the supreme test—to send a living man from the basement room on Second Avenue to the iron-walled room on Tenth Avenue. Here even von Hofen hesitated. What if something should go wrong, and the subject of the experiment should arrive at the receiver, a scrambled mess, like that which had so upset the medical world a few months before? The machine was ready, and tuned to the highest degree of accuracy; and yet we delayed.

The more I saw of Carson the less I liked or trusted him.

"Von Hofen," I said one day, "are you sure that the formula which Carson gave you is genuine?"

Von Hofen started. A troubled look came over his face. "I had not thought of that," said he. "But this night will I go to the laboratory and try it out. I am not

so much of a chemist as Carson; but a little of a chemist, yes. Enough to test the formula. We shall see."

That night, taking the little note-book from its place in the safe, we went to Carson's laboratory, which had not been used since the completion of his experiments. Here von Hofen opened the book and began to rumber over the figures which it contained. As he did so, his brow wrinkled into a deep frown.

" $H_2SO_4 + HCl + KNO_3 + H_2O^{87}$ —"
In a few moments he threw down the note-book. "It is but nonsense," he said, "a jumble of chemical symbols. It means nothing. He makes fools of us. Let us search. Perhaps the real formula is concealed here." I thought it most unlikely; nevertheless we ransacked the place thoroughly, even examining the corners of a waste basket, which stood by the desk. It is hardly necessary to say that we found nothing.

Day was breaking when, at last, we returned to the Second Avenue basement, where we sat down for a council of war.

"Von Hofen," I said, "you can bet your last dollar that that formula is resting, safe and sound, in Carson's pocket. By hook or by crook, by violence, if necessary, we must get it from him. In the meantime we must not let him suspect that we have discovered the one he gave us to be a fraud. If he knows that we even suspect it, the game is all up. With that formula in his possession, he has us by the throat. He can demand what terms he pleases. Now, what I would suggest is this—"

"Good morning, gentlemen," said a voice at the door. "What is the trouble? You seem worried about something. Has anything gone wrong with the projector?" It was Carson, wearing upon his face a sarcastic smile which would have justified murder.

"Sir," he went on, "you thought you could outwit Professor John Carson. You amuse me. The formula is mine and the machine is mine. Last night, while you were busy in my laboratory, I was busy in yours. I made a careful study of all plans, blueprints and data regarding this most ingenious invention; and I think I am now as familiar with its details as von Hofen himself. However, to guard against any possible failure of memory on my part, I took possession of all said plans and data, and have them now in my coat pocket. Checkmate!"

Von Hofen quickly spun the combination and threw open the door of the safe. It was empty.

Carson laughed.

As I turned, with clenched fists, he was standing between us and the door, with a revolver in his hand. "You spoke a moment ago," said he, "of my dictating terms. You wrong me. I have no intention of doing anything of the sort. Why should I make terms when I can have it all? I shall make short work of both of you right now, and send your remains by air route to the room on Tenth Avenue. They will be discovered on the street later on, and what is there to connect them with me? But no. There is an even more efficient way of disposing of them. I have only to—"

HE did not go on with his explanation. He was so pleased with his cleverness, and so much aroused by the little lecture he was giving us that he became a bit careless. I seized the opportunity, and sprang upon him, striking at the hand which held the revolver. He flinched, but the bell buried itself harmlessly in the ceiling. At the same instant von Hofen leaped to my assistance. I

was amazed at the strength that seemed to be in the old fellow's lean frame, and I myself am so welding, but Carson was like a thing of steel springs and wire.

The revolver was knocked to the floor, and the three of us staggered about the room, fighting like demons. I have not the slightest doubt but that Carson could have managed the two of us, but, in the struggle, he stepped upon the fallen revolver, which slipped along the floor, throwing him off his balance. He fell violently against the projector, his head striking the heavy iron frame. For a moment he was partially stunned. That moment was enough. Before he could recover himself, we laid him down. I tied his wrists and ankles with some pieces of heavy copper wire which lay upon the floor, and we bound him securely to the chair in the sending chamber of the projector. Von Hofen threw the switch. The current roared, the blue light flared, and he was gone.

"Now," said von Hofen, "we must get an officer. He is in the room on Tenth Avenue, bound hand and foot. We must get the formula from him, and then—"

"And then," I finished, "we will get him back into prison by the same means that got him out. But why in thunder didn't we get that formula while we had him here? Come on!"

Soon, accompanied by an officer, we were hurrying westward. We unlocked the iron door of the receiving room, and rushed in. The room was empty.

"He is a devil," said von Hofen. "Let us go."

Silly we returned to the basement room, where stood the now useless transmitter—useless because we had consumed the last of our Christmas in getting rid of its discoverer; and we could produce no more.

"My friend," said von Hofen, "we are dead men.

How we escaped from that room I cannot guess; but he has made similar escapes before. Somehow he is lurking. By knife, by gun, by poison, at some way, he will accomplish his purpose. I know what he was. I should have known better. We should have left him in prison."

"Nonsense!" said I. "We will have the whole police force of the city and the whole Philsonian Detective Agency into the bargain on his track. We will get him. We'll see this thing through on—"

I stopped, for von Hofen was not listening; he stood staring at a bit of wire which dangled from the projector. He took the end of the wire in his hand, and turned to see, with a most peculiar smile upon his face.

"You will not seal the police," he said, "nor the detective agency. This so small wire, which is now broken, carried the current to the condenser. Carson must have broken it when he fell against the machine. We placed him in the sending chamber, turned on the current, and poof! We have broadcast him!"

So, somewhere out in interstellar space, the vibrations of Professor John Corago and his formula are traveling, on and on, in ever-widening circles, into infinity. He will not return.

And now my reason for telling the story? Just this. If any of you chemical fellows happen to be on the trail of Element Number 87, and need a bit of indiscretion beyond the hope of having it named "Smithium" or "Jorcium" in your honor, let me say that, in a basement room on Second Avenue, New York City, there stands the greatest invention of all time, unless as a Rolls Royce out of gas, awaiting the rediscovery of that element, and there is also waiting, at my bank, in the same city, a reward of ten thousand dollars in cash for the finder.

THE END

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- How delicate can scientific theories as to gravitation, two-page and other phenomena be reported? (See page 227.)
- What is known about the plant and insect life in warm or hot waters? (See page 214.)
- What is the name of the floating sea-weed with its farms of animal life found in the Sargasso Sea? (See page 217.)
- Where would element 87 come in the table of elements? (See page 225.)
- How could a hot enough flame cut iron: how is iron now cut by the blowpipe? (See page 221.)
- What gas can pass through a plate of hot iron? (See page 232.)
- Give an example of an organized formula that will represent two different compounds. (See page 233.)
- If petroleum were exhausted, what vegetable plant could be used to supply oil? (See page 234.)
- How much heat can atomic hydrogen produce? (See page 237.)
- How was the problem of storing acetylene solved? (See page 237.)
- How many ergs per second are produced in the sun? (See page 240.)
- If all molecules in a solid bar moved in the same direction, what would happen? (See page 240.)
- What two elements constitute three-quarters of the matter of the earth? (See page 247.)
- At what speed would an airplane counteract the gravitation of the earth by its centrifugal force? (See page 248.)
- What is the characteristic of the orbit of Triton with reference to Neptune? (See page 254.)

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Piracy



¶ Then suddenly the nose of the machine was pointed once more for the zenith. With a great column of flame shooting out behind him, he was heading out toward space.

Preferred

Illustrated by
WESSO

By John W. Campbell, Jr.

Author of "When the Atoms Fell" and "The Metal Horde"

ONCE again our young author offers us a rare combination of accurate science with excellently written fiction. It is perfectly possible to get sunburned in a dark room into which only ultra-violet rays of light—so called—penetrate. The same rays can make some substances visible and fail to do so with others. A word can be written with a colorless, clear solution so as to be completely invisible on paper, except under the proper light. Why, therefore, is it not possible to go ahead of these phenomena and penetrate further into the secrets of invisibility and visibility. Mr. Campbell, in looking ahead to the future of aviation, propounds some ingenious ideas, always based on sound scientific fact, as to the possibilities of this most interesting of subjects—aviation. This is an excellent bit of scientific fiction.

HIGH in the deep blue of the afternoon sky rode a tiny speck of glinting metal, scarce visible in the glare of the bright sun. The workers on the machines below glanced up for a moment—four twenty-one it must be—then back to their work, though luke-warm it was on these automatic cultivators. Even this little break in the afternoon program was of interest in this dull monotony of green. But they would soon be working back to the plantation city. These endless fields of castor bean plants had to be cultivated, but with the great machines that did the work it required but a few dozen men to cultivate an entire county. Indeed, so vast was the area, that little helicopters were even now rising on the big cultivator, that they might fly back at the end of the day, leaving the machine where it was, ready to use in the morning.

High above them the passengers of the huge plane looked down for a moment perhaps, but continued with their papers or books immediately, for this long monotonous trip was most annoying to them. It seemed unnecessary to spend six good hours in a short 3,500-mile trip like this. There was nothing to do either, not like the trans-Pacific liners, for though they spent nearly ten hours in flight they at least had club rooms and a swimming pool. There was nothing to do, nothing to see, except a slowly passing landscape ten miles below. No details could be distinguished, and the steady low thrub of the engines, the whirring of the giant propellers, the muffled roar of the air, as it rushed by, combined to form a soothing lullaby of power. It was all right for pleasure seekers and vacationists, but the business man was in a hurry.

The pilot of the machine took a last glance at the

instruments, wondered vaguely why he had to be there at all, then turned, left the pilot room in charge of his assistant, and went down to talk with the chief engineer.

His vacation began the first of Sol, and as this was the last of June, he was still rather wondering what would have happened if he had gone as he had been half inclined to do—quit the trip and let the assistant take her through. It would have been very simple—just a few levers to manipulate, a few controls to set, and the instruments would have taken her up to ten or eleven miles, swung her into the great westward air current, and leveled her off at five hundred and sixty or so an hour toward 'Prisco. They would hold her on the radio beacon course better than he ever could. Even the landing would have been easy. The assistant had never landed a big plane, but if he had been shown which control to reset, the instruments would do it. If he forgot his instructions, he would merely have to leave it alone and in ten minutes it would land automatically—if an emergency pilot didn't come up by that time in answer to the automatic signal.

He yawned and slumped down the hall. He yawned again, wondered what made him so sleepy—he hadn't been out the night before—oh—why—worry—

He slumped limply to the floor and lay there breathing even more and more slowly.

The officials of the San Francisco terminals of The Transcontinental Airways Company were worried. The great Transcontinental express had come to the field, following the beam radio signals, and now it was circling the field with a small red-and-white flag flying, the automatic signal for an emergency pilot. They were worried, and with good reason, for on this express a large shipment of negotiable securities was being sent.

There were nearly nine hundred thousand dollars' worth of bonds. But what could attack one of these great ships. It would take a small army to overcome the crew of seventy and the three thousand passengers!

The great ship was landing gently now; the long series of broad rollers on its keel touching the ground evenly; its tremendous weight distributed over a great area, lest it sink into the springy, rubber-faced landing surface.

The small field car ran over to the great plane rapidly. Already the elevator was in place beside it, and as the officials in the car drew up under the giant wing they could see the tiny figure of the emergency pilot beckoning to them. Quickly they entered the portable elevator and were carried rapidly up to the fourth level of the ship.

What a sight met their eyes as they entered the main salon of the giant plane! All the passengers lay sleeping in their chairs, but on closer examination it became evident that they were not breathing. The car could detect no heart-beat. The members of the crew lay at their posts, as inert as the passengers! The assistant pilot by on the floor beside the instrument panel—he had apparently been watching the record of the flight. But there was no conscious man on board!

"Dead! Over three thousand people! It seems impossible—how could they have done it? Gas, I suppose, drawn in through the ventilator pumps and distributed to all the compartments of the ship. But I can not conceive of any man being willing to kill three thousand people for a mere million!

"Did you call a doctor by radio, Pilot?" The field manager was greatly depressed.

"Yes, sir. He is on his way. There is his car now." "Oh course they will have opened the safe—but let us see how it was done. I can only think some madman has done this—no sane man would be willing to take so many lives for so little." Woevily the men descended the stairs to the next room in the hold.

The door was closed, but the lock of the door was gone, apparently the magnesium-beryllium alloy had been burned away. They opened the door and entered. The room seemed in perfect order. The guard was asleep in the steel guard chamber at one side, it seemed from the doorway; the thick, bullet-proof glass made his outline a little blurred, and the color of his face was green—but they knew there too must be that same white pallor they had seen on the faces of the passengers and crew. The delicate instruments had brought in the great ship perfectly, but it was freighted with a cargo of dead! They entered the room farther, and proceeded to the safe, but it was opened as they had expected, the six-inch tungsten-iridium wall had been melted through. To the worried and depressed men this did not bring the surprise it ordinarily would have. They only glanced at the metal, still too hot to touch, and looked about the room. The bonds had been taken. But now they noticed that over the mail-clerk's desk there had been fastened a small envelope. On it was printed:

TO THE OFFICIALS OF THE SAN FRANCISCO AIRPORT

Inside was a short message, printed in the same sharp, black letters:

TO THE OFFICIALS OF THE SAN FRANCISCO AIRPORT

This plane should land safely. If it doesn't, it is your fault, not mine, for the instruments that it carries should permit it. The passengers are NOT dead! They have been put in a temporary state of suspended animation. Any doctor can readily revive them by the injection of seven c.c. of deci-normal potassium iodide solution for every 100 pounds of weight. Do NOT use HUNTER GERMANYNESS. Lower concentrations will act more slowly.

You will find that any tendency toward leprosy or cancer will have been destroyed. It will kill any existing cancer, and cure it in about one week. I have not experimented with leprosy beyond knowing that it is cured very quickly.

This is an outside job. Don't bother the people in the car.

The gas used cannot be stopped by any material I know of. You can try it with any mask—but don't use the C-321. It will react with the gas to produce a permanent suspension of animation. I would advise that you try it on an animal to convince yourselves.

I have left stock in my new company to replace the bonds I have taken.

Piracy Incorporated is incorporated under my own laws.

THE PIRATE.

On the desk beneath the note was a small package which contained a number of stock certificates. They totaled \$500,000, issued apparently as "Piracy Preferred," the stock of the new corporation, "Piracy, Inc."

"Piracy! Pirates in the air! In 2126 we have a plane attacking our air line. But thank God he did not kill all those people. 'Piracy Preferred.' Well, I think I would prefer the bonds myself. But if the Air Guard can't catch that fellow, I'm going to buy up his stock. From present appearances it looks to me as if it would pay big dividends! Ah, Doctor, you look worried! No wonder! But cheer up. If what this pirate says is true, we can reanimate them, and they will be better off for the experience!"

"I am afraid that you will never be able to bring those men back to life again, sir. I can't detect any heart action even with the amplifier. Ordinary heart action sounds like a catarrh through this instrument. I can see nothing wrong with the blood; it has not coagulated as I expected, nor is there any pronounced hydrolysis as yet. But I am afraid I will have to write out the death warrants for all those men and women. One of the people on that ship was coming to see me. That is how I happened to be on the field. Perhaps it is better so. That poor woman was suffering from an incurable cancer."

"In this case, Doctor, I hope and believe you are wrong. Read this note!"

IT was two hours before the work of reviving the passengers could be begun. Despite all the laws of physics, their body temperature had remained constant after it reached seventy-four, showing that some form of very slow metabolism was going on. As they were one by one put into the large electric blankets, and each given the correct dose of the salt, the men waited anxiously for results—and within ten minutes of the injection the first had regained consciousness!

The work went forward steadily and successfully. Every one of the passengers and crew was revived. And the Pirate had spoken the truth. The woman who had been suffering from cancer, was free from pain for the first time in many months. She was cured!

The papers were issuing extra within five minutes of the time the great plane was landed, and the radio news service was broadcasting the first "break" in a particularly dead month. All this time the news had been dead, and now it looked as though the month of Sol was going to begin with a bang! And now with time to think and investigate, the airport officials went over the ship with the Air Guard, using a fine-mesh mesh. It was soon evident that the job had been done from the outside, as the Pirate had said it was. The emergency pilot testified that when he entered, he found a small piece of wire snaring the air lock from the outside. This had certainly been put on while the ship was in flight, and that meant that whoever had done this, had landed on the great ship with a small plane, anchored it in some way, then entered the plane through the air lock at the ten-mile height. That required that he should wear a suit to protect him both from the intense cold and from the low pressure. He had probably flown across the path of the plane with his plane, leaving a trail of the gas in his way to be drawn in through the ventilator pumps. It had been washed out by the incoming good air beer, for the officials had not been affected; nor had the emergency pilot been acted on when he entered.

Now the investigation led them to the mail-room. The door had been opened by melting or burning out the lock. The heat of the combustion of the magnesium was enough for that, but the beryllium and special anti-oxidation catalyst made this very difficult. But now they realized the truly amazing fact: the safe had been opened by melting it through. There was practically no oxidation of the cut itself, but the metal door by, which had been immaculate no doubt, was coated with a thin layer of tungsten oxide. The brittle content really prevented oxidation, and with a melting point of 3500 degrees centigrade it meant that the Pirate must have an entirely new mesh. This would be as great a boon to the metallurgical industries as the cancer cure would be to the medical. It had been impossible to weld the valuable tungsten alloys they had prepared, and so they were useless. If they could only be worked, their ability to stand high temperatures would make them invaluable.

A bond shipment was due the next day, and so they would be on the watch for it. It would go through safely, for men were put on board in steel tanks hermetically welded behind them, with oxygen tanks sealed within to supply them with clean air. Automatic apparatus was arranged to keep them supplied with the correct amount of oxygen without effort on their part. The waste gases were collected by siphon, a small electrically driven pump taking care that the flow was maintained. The front of the tank was equipped with a bullet-proof glass window, and by means of electrically operated controls the man inside could control a machine-gun. Thus he was perfectly protected from the Pirate's gas and able to use his gun.

The ship was accompanied by a patrol of Air Guardsmen. Yet, several cancer cases were going with the hope of being passed,

It seemed that the Pirate's "patients" were due to be disappointed, though, for he certainly could not attack while the plane was under the protection of a patrol of Air Guardsmen; besides which, the men inside were protected by the steel tanks.

When the plane reached the neighborhood of San Francisco the Air Guardsmen were disappointed, for there had been no sign of an attack on the plane. The Pirate might well return permanently on a mission, if he were alone, as the singular signature would indicate; but it seemed doubtful and it was much more probable that he would attempt another attack in any case. Well, that just meant watching all the planes from now on. That was a tremendous job for the Air Guard, so handled! There was a vast network of plane lines! The leader of the patrol turned in an easy bark to descend the ten miles to earth, and his plane followed him. Then out of the corner of his eye he saw a flash of red and white on the silvery surface of the great plane. **THE PLANE WAS GIVING THE AUTOMATIC SIGNAL FOR AN EMERGENCY PILOT!** That could only mean that the plane had been gassed under the very eyes of his men!

The bonds were gone and the passengers gassed, but incredible as it was, the men aboard in the steel tanks were as thoroughly gassed as the rest! The note was brief, but as much to the point as was the statement of the bonds.

TO THE OFFICIALS OF THE AIRPORT

Restore as usual. The men in the tanks are asleep also—I said this gas would penetrate any material. It does. A mask obviously won't do any good, as the gas will permeate the skin. Don't try that C-32L mask. I warn you it will be fatal. My gas reacts to produce a poisonous substance when in contact with the chemicals used.

THE PIRATE

ON the thirty-ninth floor of a large New York apartment two young men were lounging about after a strenuous game of tennis. The blue curls of smoke from their paper nose slowly, to be drawn away by the efficient ventilating system. The taller of the two seemed to be doing most of the talking. In the positions they had assumed it would have been rather difficult to be sure of which was the taller, but William Mory was a good four inches taller than Richard Arnot. Arnot had to suffer under the stigma of "rust" with Mory around—he was only six feet tall. But the chosen companion of each was physical research, and in that Arnot could well have called Mory "rust," for Arnot had only one competitor in that field—namely, his father. In this case it had been "the father, the son." For many years Robert Arnot had been known as the greatest American physicist, and probably the world's greatest. More recently he had been known as the father of the world's greatest physicist. Arnot junior was probably one of the most brilliant men the world had ever seen, and he was aided in all his work by two men who could help him in a way that amplified his powers a thousand fold. His father and his best friend, Mory, were the complementary and balancing minds to his great intelligence. His father had learned through years of work the exact and best ways of performing the many difficult feats of laboratory experimentation. Mory had a mind that could develop the mathematical

theory of a hypothesis far more readily than Arcot could. Morcy had a mind more methodical and exact than Arcot, but Arcot had a mind that could grasp the local details of a problem and get the general method of solution developed with a speed that made it utterly impossible for his friend to even follow the steps he suggested.

Since Arcot justified his invention of the multiple calculus, many new ramifications of the old theories had been attained, and many developments had been possible.

But the factor that made Arcot most successful in his line of work was his ability to see practical uses for things, an ability that is unfortunately lacking in so many great physicists. Had he collected the royalties his inventions merited, he would have been a millionaire twice or three over. Instead he had made contracts on the basis that the laboratories he owned be kept in condition, and that he be paid a salary that should be whatever he happened to need. Since he had sold all his inventions to The Transcontinental Airways, he had been able to devote all his time to science, leaving them to manage his finances. Perhaps it was the fact that he did sell these inventions to the Transcontinental that made those lines so successful, but at any rate President Arthur Morcy was duly grateful, and when his son was able to enter the laboratories he was as delighted as Arcot.

Now these two were boon companions. They worked, played, lived and thought together.

Just now they were talking about the Pirate. This was the seventh day of his discovery, and he had been growing steadily more menacing. It was the great Transcontinental Airways that had suffered most repeatedly. Sometimes it was the San Francisco Flyer that went on without a pilot, sometimes the New York-St. Louis express that would come over the field flying the red-and-white flag of emergency. But always the people were reviled with little difficulty, and each time more of the stock of "Piracy, Inc." was accumulated. The Air Guard seemed helpless. Time and again the Pirate slipped in without their knowing it. Each time he convinced them that it was an outside worker, for the door was always sealed.

"Dad, how do you suppose he gets away with the things he does right under the eyes of those Air Guardsmen? He must have some system; he does it every time."

"I have a very vague idea. I was going to ask you today, if your father would let us take passage on the next liner carrying any money. I understand the insurance rates have been boosted so high that they don't dare to send any cash by air any more. They have resorted to the slow land routes. I guess they pay for it, though, in the loss of interest, while the money is out of circulation. Is there any money shipment at night?"

"No, but I have something that is just as good, if not better, for our purpose. The other day several men came into Dad's office, to charter a plane to carry them to San Francisco, and Dad naturally wondered why it was they had been referred to the president of the company. It seemed to him to be a job for a clerk. It seems the difficulty was that these men wanted to hire the ship so they could be robbed! A large group of medical men and cancer victims were going for the 'treatments.' Each one of the twenty-five hundred going was to bring along one hundred dollars. That meant

a total of a quarter of a million dollars, which is to be left on the table. They hoped the Pirate would gas them and thus cure them! Dad could not officially do this, but told them that if there were too many people for the San Francisco express, two sections would be necessary. So I believe that they are going on that second section. Only one hundred dollars! It seems a very cheap cure for cancer at that!"

"Another thing; Dad asked me to tell you that he would appreciate your help in stopping this ultra-modern pirate. So if you go down and see him in the morning, you will doubtless be able to make the necessary arrangements."

"I will do so gladly. I wonder, though, if you know more about this than I do. Did they try that C-32L mask on any animal?"

"The Pirate was telling the truth. They tried it on a dog and he went to sleep forever. But do you have any idea how that gas does all it does?"

"I don't know what that gas is, but I can tell you some things that you may not know. Did you know, for instance, that carbon monoxide will seep through a solid plate of red-hot steel? That has been known for some three hundred years now, and I have to hand it to this Pirate for making use of it. Even in the war of 2075 they didn't think of it! He has just found some gas that has these sleep-producing properties in very low concentrations, and at the same time is able to penetrate to an even greater extent than carbon monoxide. It is just an amplification of known properties."

"I was wondering how he stores that stuff. It reminds me of the old farmer and his smart son who had almost discovered the Universal Solvent."

"Well son," said the old farmer, "I suppose it'll be a damned good thing to have, but what you going to keep it in? Similarly, if this gas leaks through everything, what are you going to keep it in? I wonder if he doesn't make it as fast as he uses it, by allowing the two constituents to react? It might well be simple enough to store them separately, and the air-stream blowing past him would carry the gas behind him, so permitting him to lay a stream of it in front of the big plane. Is that about it?"

"That was about what I had figured. One of the things I want to do when I go with that Invald Special tomorrow is to get some samples for analyses."

"Whew, that's a pretty big order, isn't it, Dick? How are you going to handle it, or even get it into your apparatus?"

"Easily enough so far as getting the sample goes. I have already had some sample bottles made. I have one of them in the lab—excuse me a moment." Arcot left the room, to return a few minutes later with a large aluminum bottle. "This bottle has been pumped out to a very good vacuum. I then swept it out with helium gas. Then it was pumped out again. I hope to take this into some gas-filled region, where the gas will be able to leak in, but the air won't. When it comes to going out again, the gas will have to fight air pressure, and will probably stay in. I cannot hope to find its molecular weight by any normal means. Probably the Pirate doesn't know it—but I will be able to get a known weight of the sample, the weight being the difference between the weight before and after the gas struck. That is why I used helium in sweeping the bottle out. It

will not be in the compound, that is certain. It is absolutely impossible for it to combine. It will weigh very little and won't offset my readings, and won't react with the gas itself. I can't hope to learn much that will be very useful, for the organic tables are so blasted complex, that a mere empirical formula won't mean a thing. C_2H_6O is the formula for ethyl alcohol—see it's the formula for methyl ether. It may be a single, double or triple bonded compound—but I can't tell. I will be able to get the empirical formula, though, for any organic compound is apt to decompose easily, and I will just heat my cylinder in a furnace till the gas is broken down, then it will be easy to analyze the residue."

"I am not a chemist! You know that, but I know that the amount of gas you will get in that bottle will not weigh as much as a gram. Now how do you intend to analyze that?"

"They have been making analysis runs on such small amounts of compounds that they had to use powerful lenses in watching the reactions! Two hundred years ago an Austrian developed micro-analysis. Remember that in organic chemistry it is frequently necessary to make an analysis of some substance that has been derived only after many long months of hard work. Frequently the entire sample will weigh not more than a hundredth of a gram. The chemist must run at least three or four analyses on that. He had to work with pinhead amounts! It will be no great amount of labor for Jackson to work it out. It will probably irritate his chemist's soul to make an analysis and have to stop at the empirical formula, but I don't see how he can do any more!"

"Beautiful scheme! I hope you can find out something about it!"

THE next morning saw Arcot in President Morey's private office, having a long conference with him. At the end of it, he left the office, ascended to the roof, and climbed into his small helicopter, rose to the local traffic level, and waiting his chance, broke into the traffic bound for the great airfield over on the Jersey district. A few minutes later he landed on the roof of the Transcontinental Airways shops, entered them, and went to the office of the Designing Engineer, John Fuller, an old schoolmate. They had been able to help each other before, for Fuller had not paid as much attention to theoretical physics as he might have, and though he was probably one of the outstanding aeronautical designers, he often consulted Arcot on the few theoretical details that he needed. Probably it was Arcot who derived the greatest benefit from this association, for the ability of the designer had many times brought his theoretical successes to practical commercial production. Now, however, he was consulting Fuller, because the plane he was to take that afternoon for San Francisco was to be slightly changed for him.

He stayed in Fuller's office for the better part of an hour, then returned to the roof and thence to his own roof, where Morey junior was waiting for him.

"Hello Dad! I heard from Dad that you were going this afternoon, and came over here. I got your note and I have the things fixed up here. The plane leaves at one, and it is ten-thirty now. Let's eat lunch or its equivalent, and then start. Dad asked me to see how good that engineer on this plane is or explain-

ing the stuff. You know the engineers are supposed to be able to tell those visitors, who have passes, all about it. I am going to try to get there early, and we have passes—John Smith is yours and mine is Charles Black. Let's see—we'll be English."

It was half-past eleven when they reached the flying field. They went directly to the private office which had been assigned to them aboard. It was right next to the mail-room, and through the wall between the two a small hole had been cut. Directly beneath this hole was a table, on which the two men now set up a small moving-picture camera they had brought with them.

"How many of the gas sample bottles did you bring, Bill?" asked Arcot.

"Jackson had only four ready, so I brought those. I think that will be enough from what he said. Have we got that camera in place right now?"

"Everything's O. K. I believe. Let's see your engineer."

The chief engineer was lounging about in a large chair in his cabin. The walls of the little metal rooms were lined with meters and rheostat controls. He wished they would get started. He was a little disgruntled at present, his mates had been kidding him at the lunch room—he was now "chief engineer of the Invalid's Flying Wheel Chair"! He was rather glad to be gassed on these trips. It made the trip even shorter. He glanced up at the long rows of meters and smiled. What did they spend all that money for? No one ever paid any attention to those things except once in every month, when the planes were run by the shop specialists; then they checked things up, but the automatic devices managed the whole thing anyway. His principal duty lay in keeping his men at the engines, and inspecting the apparatus occasionally. But if anything went wrong—a plane had had trouble three years ago and descended to the six-mile level before the engineer had been able to get the machines working correctly again. No hum—buffo—some visitors. Well, here was a little diversion while he waited for the starting signal. English they were.

"President Morey sent us to see you. We are trying to collect some material on American lines, and we are touring your country. We would greatly appreciate it if you would just tell us the story from the beginning." Hm, friends of the president himself—well—

"I'll be glad to help you all I can, Mr. Smith. What would you like to see first?"

"Well, I think we'd best see the engines first, if possible."

"All right, sir. I guess we can go down to the main engine room in the nose of the ship. This is the Chief Engineer's control room. That board there represents the main engine. It covers most of that side of the room; there are most of the controlling relays for starting and running it. The engines are really run by the control mechanisms. You know these were begun over two hundred years ago, and through that time they have passed through all the stages. First they were indicators, watched by men who then acted on their information. Then about that time relays were developed to control the action of the big planes that developed. The first of these was the DO-X, the one they have in the National Tectonic Museum. They got so big one man couldn't handle them, and then the

relays took over the job. By that time the instruments had become more accurate, and they just looked the relays directly to the instruments.

Now we have these ships. Each airline has a radio beam station at each end, and several scattered along the way. These direct the instruments which control the direction of the ship. The height is controlled by the radio reflection altimeter. This gives us ground height, the altitude from the ground itself, not from sea level—it makes it possible for these big planes to land themselves automatically. The plane will no doubt be passed, as you probably know, and it will then correct its way controlled automatically. Freight lines frequently operate that way during rush periods. No pilot goes on them, and no crew. There is a landing beacon that projects a radio wave from the exact center of the field. The plane heads for this, then lands gently. A fall of a foot or so is easily taken care of by the shock absorbers.

"You noticed the roller landing gear? That has not been adopted widely abroad as yet, but it makes for easier landings. The weight of the ship is distributed over much greater area, and it does away with a tremendous amount of head resistance. Those rollers have been nearly completely counterbalanced, and wheels cannot be.

"Here is the main engine room. That engine there develops about 25,000 horsepower. There are two smaller engines, one on each side, out in the wings. These develop only about 15,000 apiece. These are the usual American type engine, the Arcot coal engine, patterned after the old Diesel engine. They were developed by Arcot senior about fifty years ago, and have been little improved since, though young Arcot has added a new type of vibration damper. They burn powdered coal, by the compression ignition method. Coal is powdered to an exceedingly fine dust and blown into the cylinders, where the up-stroke compresses the air to about 1,500 pounds to the square inch. The fuel is burned with about thirty-nine percent efficiency, as compared to the old di-phenyl-oxide vapour turbines which developed about ten per cent at best. The fuel is solid, and easily handled, and further, there is no fire risk.

"The engines have sixteen cylinders of rather small size, for it was found that small cylinders with great pressures and several in number gave higher efficiency and less vibration than fewer large ones. The big mechanism up there reduces the speed of the engine shaft to a speed that can be used on the prop. The main prop is forty feet sweep, the two others are each thirty feet.

"When the oil supplies gave out in 2060-80, the engineers were mighty hard pressed. Fuel they had in the form of coal! For many years the problem had been staring them in the face, and they had really solved it. Of course there still remained the oil states, but they could not be worked economically because of the cost of extracting the oil. It was cheaper to import the lubricants they had to have. These they tried to do out with copious amounts of graphite, and re-refining. Then about 2070 came genius, money, claim the honor, got the very sensible idea that it was time they started raising their own oil. Now, as we fly over western Kansas, you will see vast fields of green plants. From there, clear across the country, the green will continue.

They are the gigantic plantations where our oil and most of our fuel is grown. The cornstalks are used as fuel and a dozen other things by fermentation by particular bacterial ferments. Alcohol is the usual product, but many others can be obtained. Further west, the staple crop is castor oil beans. That is the source of our lubricating oil. Some man dug the secret out of some century and a half-old book, for in the days of the development of the automobile it was found that the petroleum was not good enough at that time, to use in the expensive parts, and they used castor oil, which did not trouble them by dissolving the gasoline. That big tank up there is the main supply. It is loaded with synthetic graphite also, for even that needs a little thinning to go round. Our fields aren't big enough yet. The castor oil bean plant is one of the necessities of this country. It supplies our oil, and it helps supply our alcohol. Of course, we do use hydrogenated coal to a slight extent still, but the main-fuel is alcohol. How do you manage in England? You do not have enough area for castor oil production, and not enough coal left."

ARCOT and Morry had not been prepared for this, but Morry happened to be up on those facts at present from a recent trip to European cities.

"Why, we are using methyl alcohol as our fuel. Your ethyl alcohol used commercially can be prepared by fermentation with your great area, but we have been forced rather to extremes. As you know, we are now synthesizing the staple items of our food directly. Our coal too is nearly exhausted and we are beginning to wonder if the old idea that Englishmen had was so good. You know we used to sell our coal by the millions of tons to ships every year. Now we need it badly. We have been forced to use our great deposits of limestone and other carbonates as our source of carbon. The usual practice is to electrolyse sea water for the chlorine and the sodium as well as the hydrogen. The H and the Cl are burned together to give the acid. This is used to treat limestone to produce the CO₂ needed in industry, the heat of the reaction producing CO₂ by the direct decomposition of the limestone. The calcium chloride is now a very important by-product, while the CO₂ thus obtained is used to produce the necessary foods and fuels. The usual system is to treat it with hydrogen gas and produce methyl alcohol. This is then synthesized up to sugars and other simple foods. The power we use comes directly from the sea by the process of using the difference in temperature of the sea water at great depths and on the surface. The power stations have been built all along the coast now, and great transmission lines reach inland to supply the cities with power.

"There are no chimneys in England today. The newest process looks as if it had great promise; it is simpler than the old methods, and uses far less energy. They pass air through a liquid under great pressure, and in this way absorb the CO₂ content of the air. The thing becomes most interesting to look on in the whole! The energy comes from the sun. It is used to stabilize carbohydrate compounds, the carbon coming from the air as CO₂, and the hydrogens from water. The resultant foods are used by the developers of the machine, and we have at last gotten back to the model the plant offered millions of years ago! This time, with the sun as our source of energy, we don't have to worry about running out of fuel!"

"In this country, Mr. Black, we have been forced to use our coal very sparingly for all but absolutely essential industries. We need it for metallurgical processes. What do you use?"

"That was one of our big problems. We now find it necessary to get most of our metals electrolytically, the power being generated, as I state, from the sea. It is cheap, and our costs are not so much greater than yours, and our supply of power will last forever. The only trouble is that the metals are showing signs of exhaustion. As you know, we now have to import practically all our metals except iron, but even that shows signs of giving out. France is in a like condition, her coal and iron are nearly gone, and even Germany is feeling the stress pretty badly. Russia and Siberia, with their vast area, have little to worry about. They are still producing oil in plentiful amounts. Their platinum alone seems to be exhausted. But the day will come! I wonder what we will do when there is no more high-grade iron ore?"

"Let's not think about that. It probably won't come in our day."

"Probably not; still, there is the question."

While the men had been talking, the great landing field had been gradually dotted with people moving over toward the great ship. It would start now in about twenty minutes. The engineer suggested that they go upstairs and watch things from the pilot's room.

"See the big tubes on top of the roof of the station there? Those are the radio beacon generator tubes. They, and others like them in San Francisco, will be directing the ship as she flies along her route, ten miles up. As in the European lines, we fly at about ten miles, thus avoiding any danger of mountains, cutting down our resistance, and increasing the safety factor of landing. With the main engine alone going, we can reach San Francisco from New York once we get started. With some of the engines going we can always glide to one of the big cities for a safe landing. So great is the area of gliding range that there is no place on all earth where we would not be within reach of a safe landing. There is no danger of the engines failing anyway, so we really don't have to worry. Should they have a breakdown after the pilot and the crew have been passed, the instruments will cut them out automatically lest they wreck the ship, and then it will make a safe automatic landing at any nearby city, by picking up the strongest of the local gas beacons. Usually, if there is any emergency, the pilot acts back and just lets the machines handle it. They never make a mistake, as long as they are working. When they stop working, the pilot takes charge. But they have never been known to stop working. That large case over there conceals a big battery of constantly charged storage cells that operate the instruments. We do not take any chance on power failure."

"See—they are getting ready to take-off. They will close the air doors soon. I must go back to my office, but you can stay here and talk to the pilot—he won't have anything to do anyway!"

"No, I won't, Chief, but that will be because the pilot's had sense enough to invent machines to make life easy!" returned the pilot. "But I will be glad to help you gentlemen if I can. There—hear that whir—now it has almost gone. They started the ventilator machinery. That will draw air in from outside, and pump it up to the necessary pressure for breathing at the ship, no matter what the external pressure is. There is a much

larger pump attached similarly to each of the engines to supply it with the necessary oxygen. You would think that that would take a lot of the power from the engines, but any loss in pumping the air in is made up by the lower back pressure on the exhaust. Now the engines are starting—feel the momentary vibration—then it goes as they get under way. The props haven't been thrown in gear as yet. The airtight door is closed now; the portable elevator is backing off, going back toward the field house. I don't think it is particularly probable. But, then, one wouldn't say a thing like this machine loaded very expeditiously while it is on the ground, yet in the low resistance air, ten miles up, we will make over six hundred at times. Well, it's one now, and the starting signal is due. I am afraid I must be excused now."

Arvid and Mervy returned to their room, convinced that both pilot and engineer were intelligent and courteous.

"Well, now we have a nice long wait till we get to San Francisco and back, Dick, but you will have something to tell them!"

"I hope so, Bill, and I hope that as soon as we get there, we can get ready to take the midnight plane from San Francisco, which will get us in at nine o'clock tomorrow morning, New York time. I wish you would go right to your father's office and ask him over to our place for supper, and see if Pulker can come too. I think we will be able to use that molecular controller on this job; it is almost finished, and with it we will need a good designing engineer. Then our little movie show will no doubt be of interest!"

THESE was a low rumble that quickly mounted to a staccato roar as the great propellers began whirling and the engines took up the load. The ground began to flash behind them; the great plane was waddling sideways across the surface, like a great duck, then suddenly, as flying speed was reached, there was a slight start, the roaring bark of the engine took on a deeper tone, the rocking stopped and the ground was dropping away. Like some mighty wild duck, the plane was in the air, a graceful, scintillant thing, wheeling in a great circle as it headed back for San Francisco, for the wind had been from the east when the ship took off. Now the plane was climbing steadily in a long loam; up, up, up she went, and gradually the terrific roar of the engine died to a low throbbing hum as the low pressure of the air silenced the noise, a sound proof vacuum was around them. Below them the great city was contracting as the great ship rode higher. The tiny private heliopes were darting about below them like streams of sigh invisible individuals, creeping black lines among buildings of the cities. The towering buildings above in the noon sun in curious hues as the colored life facing reflected the brilliant sunlight with glowing warmth of color.

It was a city of indescribable beauty now. It was one of the things that made this trip so worth-while.

Now the shining city was dropping behind them, and only the soft green of the Jersey hills, and the deep purple-black of the sky above surrounded them. The sun was blazing high in the night-black heavens, and the muffled air gave such slight diffusion effect, that the screen was readily visible with the aid of a smoked glass. Around the sun, long banners in space, the Zodiac light glowed dimly. Here and there some of the brighter stars gleamed in the dark sky.

Below them the landscape was swinging slowly by. Even to those men who had made the trip dozens of times, the sight was one to inspire, and hold one's attention. It was such a thing as had never been visible before the development of these super-planes. Whole flying observatories had been made that had taken photographs at heights of fifteen miles, where the air was so rarified that the plane had to travel close to eight hundred miles an hour to stay up. Great power was needed to maintain this speed, and only on rare occasions were the machines taken so high, but the flexibility allowed for better observation of solar eclipses than had ever been possible, for but once in a century world an eclipse occur in the region of a large observatory.

Already ahead of them Aroot and Macey could see the great splash of color that was Chicago, the mightiest city of the Earth. Situated as it was in the heart of the North American continent, with great water and geared landing facilities and broad plains about it, it made a perfect air-port, and the sea no longer meant much, for it was now only a source of power, recreation and food. Ships were no longer needed. Planes were faster, and the air resistance being so much less, it was more economical also. With its already great start toward ascendancy, Chicago had rapidly forged ahead, as the air lines developed with the great super-planes. The European planes docked here, and it was the starting point of the South American lines. But now, as they swung high above it, the glistening walls of soft-colored tiles made it a great mass of changing, flashing color beneath them. As they passed they could see a great air-line, twice the size of their plane, taking off for Japan, its five great propellers visible only as flashing lights as it climbed up toward them. Then it was out of sight.

It was over the green plains of Nebraska that the Pirate worked, so there the men became more and more alert, waiting for the first sign of abnormal sleepiness. The tension made them yawn, and each immediately wanted to start the camera lest they miss the rider. They soon realized, however, that it was only their nervousness that made them yawn so. They sat quietly, not talking, listening intently for some new note, but knowing all the while that any sound the Pirate might make would be more than drowned out in the whirring roar of the air sweeping past the giant airfoils of the plane.

It was Aroot who first began to feel sleepy, and soon he decided that it was not imagination. He glanced sleepily toward Bill, who was already lying down. He found it a tremendous effort of the will to make himself reach up and close the switch that started the little camera whirring almost noiselessly. It seemed he never pulled his arm back—he just—by there—and —

A white uniformed man was bending over him as he opened his eyes. To one side of him he saw Macey sliding down at him.

"You're a fine guard, Aroot. I thought you were going to stay awake and watch them!"

"Oh, no, I left a much more efficient watchman! It didn't go to sleep—*is* you willing to bet?"

"No, it may not have gone to sleep, but the doctor here tells me it has gone somewhere else. It wasn't found in our room when we woke up. I think the pirate found it and confiscated it. All our luggage, including the gas sample bottles is gone."

was brought down by an emergency pilot and Fuller had him fixed for me. He took care of the baggage so that no member of the pirate's gang could steal it. There might have been some of them in the ground crew. They will be turned over to us as soon as we see the emergency men. I don't have to be here any longer, do I, doctor?"

"No, Dr. Aroot, you're all right now. I would suggest that for the next hour or so you take it easy to let your heart get used to beating again. It stopped for some two hours, you know. It is hard to change a habit of some twenty-five or six years, but once changed, it is hard to change back. You will be all right, though."

Five men were sitting about the table, discussing the results of the last raid in particular as related to Aroot and Macey. Fuller, and President Moray, as well as Dr. Aroot, senior, and the two young men, were there. They had consistently refused to tell what their trip had revealed, saying that pictures would speak better than they could. So now the men adjourned to the library where a small motion picture projector had been set up. As they seated themselves in the darkened room, Aroot set up the small screen, then returned to the projector and started it. At once they were looking at the three dimensional image of the mail-room about the air liner.

"I have cut out a lot of useless film, and confined the picture to essentials. We will now watch the pirate at work."

Even as he spoke they saw the door of the mail-room open a bit, and then, to their intense surprise, it remained open for a few seconds, then closed. It went through all the motions of opening to admit someone, yet no one entered!

"Your demonstration doesn't seem to show much yet, son. In fact, it shows much less than I had expected," said the senior Aroot. "But that door seems to open easily. I thought they locked them!"

"They did, but the Pirate just burned holes in it, so to save expense, they don't anymore."

NOW the scene seemed to swing a bit as the plane hit an unusually bad air bump, and through the window they caught a glimpse of one of the circling Air Guardians. There suddenly appeared in the air a bit of flame. It hung in the air above the safe for an instant; described a strangely complicated set of curves; then, as it hung for an instant in mid-air, it became a great flare. In an instant it narrowed down to a little point of brilliant red flame. This described a complex series of curves and touched the safe at the top. In an instant—about time the eight-thick thickness of tungsten-iridium alloy was glowing incandescent and running around molten; a large flare of the red flame sprang out to surround the point of flame, and this blew the molten metal to one side, a shower of brilliant sparks. It was cutting the metal rapidly now, not burning it, but blowing it to one side, perfectly fluid.

Soon the torch had cut a large circular piece of metal nearly free, and it would soon drop into the safe. Now the torch left the safe, again retracting itself in that uncanny manner, no force seeming either to supply it with fuel or to support it; thus, yet it burned steadily, and worked rapidly and efficiently. No, in mid-air, it hung for a second.

"I'm going to work the projector for a few moments by hand so that you may see this next bit of film."

Arcof moved a small switch and the machine blinked, giving a strange appearance to the seemingly solid images that were thrown on the screen.

The pictures seemed to show the flame slowly descending till it touched the metal again. Again the metal glowed, then, as suddenly as the extinguishing of a light, the safe was gone! It had disappeared into thin air! Only the incandescence of the metal and the flame were visible.

"It seems the pirate has solved the secret of invisibility. No wonder the Air Guardsmen couldn't find him!" exclaimed Arcof, senior.

The projector had been stopped exactly on the first frame, showing the invisibility of the safe. Then Arcof backed it up.

"I think you are right, dad," he said, "but notice this next frame."

Now there appeared a picture of the room again, the window beyond, the mail clerk sitting at his desk, everything as before, except that in the place of the safe, THERE WAS A SHADOWY, SHAPE VISIBLE PART, the metal glowing brightly, and beside it there was visible a shadowy man, holding the safe with a shadowy bar of some sort. And through both of them the frame of the window was perfectly visible, and, ironically, an Air Guardsman.

"It seems that for an instant his invisibility failed here. Probably it was the contact with the safe that caused it. What do you think, dad?" asked Arcof, junior.

"It does seem reasonable. I can't see off hand how his invisibility is even theoretically possible. Have you any ideas?"

"Well, dad, I have, but I want to wait till tomorrow night to demonstrate them. Let's adjourn this meeting, if you can all come tomorrow."

The next evening, however, it seemed that it was Arcof himself who could not be there. He had asked Morcy, junior, to tell them he would be there later, when he had finished on the lab.

Dinner was over now, and the men were waiting rather impatiently for Arcof to come. They heard some noise in the corridor, and looked up, but no one came.

"Morcy," asked Fuller, "what did you learn about that gas the pirate was using? I remember Arcof said he would have some samples to analyze."

"As to the gas, Dick found out but little more than we had already known. It is a typical organic compound, one of the metal radical type, and contains six atoms of thorium. This is a bit radioactive, as you know, and Dick thinks that this may account in part for its ability to suspend invisitation. Thorium has a valence of four, as have many of the semi-organic metal radicals. It is thus able to replace carbon in some structures. However, since it was impossible to determine the molecular weight, he could not say what the gas was, save that the empirical formula was $C_{12}Th_6O_{12}N_4$. You can see it is a very complex molecule. It broke down at a temperature of only 85° centigrade. The gases left consisted largely of methane, nitrogen, and methyl ether. Dick is still in the dark as to what the gas is. Look over these!"

The men turned with one accord toward the opposite end of the room, looked, and seeing nothing particularly unusual, glanced back rather puzzled. What they then saw, or better, failed to see, puzzled them still more. There was no doubt Morcy could not be seen.

"Why—why where—ohhh! Quick work, Dick!" The senior Arcof was laughing heartily, and as the astonished and curious pair looked toward him, he stopped and called out, "Come on, Dad! We want to see you now. And tell us how it is done! I rather think Mr. Morcy here—I mean the visible one—is still a bit puzzled." There was a short laugh from the air—certainly there could be nothing else there—then a low but distinct click, and both Morcy and Arcof were simultaneously present, coming instantaneously from nowhere, as one's senses could be relied on. On Arcof's back there was strapped a large and rather hastily wired mechanism—one long wire running from it and out into the laboratory. He was carrying a second piece of apparatus, similarly wired. Morcy was tracking a short metal bar that Arcof held extended in his hand, using a table knife as a connector, lest they get radio frequency burns on making contact.

"I have been very busy getting the last connection of this portable apparatus rigged up. I have the thing in working order, as you see—or rather, didn't see. This other outfit here is the thing that is more important to us. It is a bit hazy, so if you will clear a space, I will set it down. I look out for my power supply there—that wire is carrying a rather dangerously high E.M.F. I had to connect with the lab. power supply to do this, as I had no time to rig up the beautiful little mechanism the pirate must have."

"I have duplicated his experiment. He has simply made use of a principle known for some time, but as there was no need for it, they hadn't used it. It was found back in the early days of radio, as early as the first quarter of the twentieth century, that very short wavelengths effected peculiar changes in metals. It was shown that the plates of tubes working on very short waves became nearly transparent. The waves were so short, however, that they were economically useless. They would not travel in usable paths, so they were never developed. Furthermore, the apparatus developed could not be made to handle them. In the last war they tried to apply the idea for making airplanes invisible, but they could not get their tubes to handle the power needed, so they had to drop it. However, with the tube I recently got out on the market, it is possible to get down there. I think our friend the pirate has developed this thing to a point where he could use it. You can see that invisibility, while interesting, and a good thing for a stage and vaudeville, is not very much of a commercial and. No one wants to be invisible in any honest occupation. Invisibility is a tremendous weapon in war, so the pirate just started a little private war, the only way he could make any money on his invention. No one wants it. People can't use an invisible plane—they would run too much risk of being crashed. If two of the blarney things were in the neighborhood, it could never be known where one might run into the other."

"The gas, too, made the thing attractive. He had probably discovered that before."

"THE whole thing looks to me to be the work of a madman. He is not violently insane; probably just has one particular obsession. His scientific hump certainly shows no signs of weakness. He might even be some new type of kleptomaniac. He steals things, and he has already stolen far more than any man could ever have any need of, and he leaves in its place a 'stock'

certificans in his own company. He is not violent, for hasn't he carefully warned the man not to use the C-32L mask?

"And his careful instructions as to how to revive the people! He is insane in one branch only. But he has developed this machine for invisibility, and naturally he can fly in and out of the air guard, and they will never know he's there, provided their ultraphone detectors don't locate him. But they have a mighty poor chance. I believe that he uses some form of glider. He cannot use an internal combustion engine, for the light of the explosions in the cylinders would be as visible as though the cylinders were made of clear fused quartz. He cannot have an electric motor, for the storage of his energy would be a weighty matter—the coils would necessarily weigh too much. Furthermore, if he were using any sort of prop, the noise of the air around it would give him away. If he used a glider, the noise of the great ship as near would be more than enough to kill the slight sounds. The glider could hang above the ship, then dive down upon it as it passed beneath. He has a very simple system of anchoring the thing, as I discovered to my sorrow. He has a powerful electro-magnet and just turns that on when he lands. The landing deck of the big plane was right above our office aboard, and I found my watch was doing all sorts of antics today. It lost an hour this morning, and this afternoon it gained two. I found out it was very highly magnetized—I could pick up needles with the balance wheel. I demagnetized it; now it runs all right. I noticed you do the same thing to yours later, Bill."

"I had to. It took me twenty-five minutes to walk two blocks, according to my watch. The next two blocks I did in a minute and forty-five seconds."

"But to get back, he anchors his ship, then, leaving it invisible, he goes to the air lock, and enters. He wears a high altitude suit, and on his back he has a portable invisibility set and the fuel for his torch. The gas has already put everyone to sleep, so he goes into the ship, will be visible, and melts open the safe."

"His power supply for the invisibility machine seems to be somewhat of a problem, but I think I would use a cylinder of liquid air, and have a small air turbine to run a high voltage generator. He probably uses the same system on a larger scale to run his big machine on the ship. He can't use an engine for that either."

"That sort of his is interesting, too. We have had atomic hydrogen welding for some time, and atomic hydrogen releases some 100,000 calories per mole of molecular hydrogen, two grams of gas give one hundred thousand calories. Oxygen has not been prepared in any commercial quantity in the atomic state. From watching that man's torch, from the color of the flame and other indications, I gather that he uses a flame of atomic oxygen-atomic hydrogen for melting, and surrounds it with a protecting jacket of atomic hydrogen. Since oxygen has two valences instead of one, its heat of formation is greater. The center flame probably develops a temperature of some 4000° centigrade, and will naturally make that tungsten alloy run like water. But there has never been any commercial way of storing atomic hydrogen; it has always required a big electrical power supply, and expensive apparatus. Since this fellow was able to use it as a portable welding and cutting tool he has a means of storing it. I rather believe he dissolves it in some substance. Remember the difficulties

they had in storing acetylene? They could not store it in the liquid state as it would often explode. They finally solved the problem by dissolving it in acetone. I think that the pirate has found some liquid that will store his atomic hydrogen under slight pressure. That is the only way he could produce the results he has. Now, as to this machine here.

"It is, as I said, a machine which impresses very high frequencies on the body it is connected with. This puts the molecules in vibration at a frequency approaching that of light, and when the light impinges upon it, it can pass through readily. You know that metals transmit light for short distances, but in order that the light pass, the molecules of metal must be set in harmonic vibration at a rate approaching the frequency of light. If we can impress such a vibration on a piece of matter it will then transmit light very freely. If we impress this vibration on the matter, say the body, electrically, we get the same effect, and the body becomes perfectly transparent. Now, since it is the vibration of the molecules that makes the light pass through the material, it must be stopped if we wish to see the machine. Obviously it is much easier to detect me here among solid surroundings, than in the plain high in the sky. What chance has one to detect a machine that is perfectly transparent when there is nothing but perfectly transparent air around it? It is a curious property of this vibrational system of invisibility that the index of refraction is made very low. It is not the same as that of air, but the difference is so slight that it is practically within the limits of observation error; so small is the difference that there is no 'rainbow' effect. The difference of temperature of the air would give equal effect."

"Now, since this vibration is induced by radio impulse, is it not possible to impress another, opposing radio impulse, that will overcome this tendency and bring the invisible object into the field of the visible once more? It is; and this machine on the table is designed to do exactly that. It is practically a beam radiator, projecting a beam of wavelength 69 meter, a wavelength that alone would tend to produce invisibility, but in this case it will make me visible. I am going to sound right here, and Bill can operate that set."

Arcot strode to the middle of the room, and then Macey turned the reflector of the beam set on him. There was a low snap as Arcot turned on his set, then he was gone, as suddenly as the curving of darkness when a lamp is extinguished. He was there one moment, then they were staring at the chair behind him, knowing that the man was standing between them and it, knowing that they were looking through his body. It gave one a strange feeling, an uncomfortable tingling along the spine. Then the voice—it seemed to come from the air, or some disembodied ghost as the invisible man called to Macey.

"All right, Bill, turn her on slowly."

THERE was another snap as the switch of the disrupter beam was turned on. At once there was a noticeable fogginess in the air where Arcot had been. As more and more power was turned into the machine, they saw the man materialize out of thin air. First he was a mere shadowy outline that was never fully above the level of conscious vision. Then slowly the outlines of the objects behind became dimmer and dimmer, as the body of the man was slowly darkened, till at last

there was only a swarting ax on him. With a snap Morry shut off his machine and Aroot was gone again. A second snap and he was solid before them. He had shut off his apparatus too.

"You can see now how we intend to locate our invisible pirate. Of course we will depend on directional radio disturbance locating devices to determine the direction for the invisibility disrupter ray. But you are probably marveling at the greatness of

the apparatus I am working on. It is very important that you be here, Fuller. I am going to need you in the work to follow. It will be another problem in design if that works out, as I hope it will."

"I'll certainly make every effort to be here, Aroot," Fuller assured him. "I can promise you a tough problem as well as an interesting one. If the thing works, as I expect it to, you will have a job that will certainly be a feather for your cap. Also it will be a change."



the genius who can design and construct this apparatus all in one day. I will explain the miracle—I have been working on short wave phenomena for some time. In fact, I had actually made an invisibility machine, as Morry will testify, but I realized that it had no commercial benefits, so I did an experiment with it beyond the laboratory start stage. I am still working on a somewhat different piece of apparatus that I believe we will find very relevant to this business. I will ask you to adjourn after tonight's meeting for another twenty-four hours till I can finish

As wave and more power was turned into the machine, they saw the man materialize out of thin air.

"Well, with that indictment, spoken by you, I will certainly be here. But I think that pirate could give us some hints on design. How does he get his glider ten miles up? They have done some gliding already. The distance record took someone across the Atlantic in 2028, didn't it?" I know they have about stopped, but it does seem that ten miles straight up is a bit too steep for a glider. There are no vertical air currents at that height."

"I meant to say that his machine is not a true glider, but a semi-glider. He probably goes up ten miles or more with the aid of a small engine, one so small it takes him all morning to get there probably. It is very seldom anyone goes that high. Of course, there are some who are trying the ceiling of their new machines, but they are mighty few—it is too long drawn out a procedure. It wouldn't pay for the big Transcontinental planes to go that high, just the sheer power and work done getting there would be prohibitive if they couldn't use it all on the last part of the flight by gliding. You know that better than I do. And it would be easy for a plane to pass through the lower traffic lanes, then, being invisible, mount high and wait for the air liner. He can't use a very large engine, for it would drag him down, but a hundred horsepower or so would weigh only about 50 pounds if one of the new tungsten-trifurium blade turbine engines is used. I think we can draw a pretty good picture of his plane from scientific logic. It probably has a tremendous wingspread and a very high angle of incidence to make it possible to glide at that height, and the engine and prop will be almost laughably small."

The next evening the meeting was resumed, and there was considerable questioning as to the nature of the discovery that Arcot was going to announce, for even his father did not know. The two men worked at separate laboratories, except when either had a particularly difficult problem that might be solved by the other. All knew that the new development lay in the field of short wave research of some sort, but they could not find out in what way it concerned the problem in hand.

At last the meal was over, and Arcot was ready to demonstrate.

"Dad, I believe that you have been trying to develop a successful solar engine. One that could be placed in the wings of a plane to generate power from the light falling on that surface. In all solar engines, what is the greatest problem to be solved?"

"Well, the more I investigate the thing, the more I wonder which is the greatest. There are a surprising number of annoying problems to be met. I should say, though, that the one big trouble with all solar engines, eliminating the obvious restriction that they decidedly aren't dependable for night work, is the difficulty of getting an area to absorb the energy. If I could get enough area, I could use a very low efficiency and still have cheap power, for the power is absolutely free. The area problem is the greatest difficulty, no doubt."

"Well, I think you have a pretty good area to use, if you can only harness the energy it absorbs. I have really developed a very efficient solar engine. The engine itself requires no absorbing area, as I want to use it; it takes advantage of the fact that the earth is absorbing quadrillions of horse-power. I have merely tapped the power that the earth has already absorbed for me. Come here."

He led the way down the corridor to his laboratory, and switched on the lights. On the main laboratory bench was set up a complicated apparatus of many tubes and

heavy bus bar connectors. From the final tube two thin wires ran to a long tubular coil. To the left of this coil was a large relay switch, and a rheostat control.

"Turn on the relay, dad, then slowly rotate the controller to the left. And remember that it is rather powerful. I know this doesn't look like a solar engine, and nine o'clock at night seems a peculiar hour to demonstrate such a thing, but I will guarantee you results—and probably more than you expect."

Dr. Arcot stepped up to the controls and closed the switch. The lights dimmed a bit, but immediately brightened again, and from the other end of the room came a low, steady hum as the big transformer took up the load.

"Well, from the sound of that ten K.W. transformer there, if this engine is very efficient we ought to get a terrific amount of power out of it." Dr. Arcot was smiling amusingly at his son. "I can't very well control this except by standing directly in front of it, but I suppose you know what you're doing."

"Oh, this is a laboratory model, and I haven't gotten the thing into shape really. Look at the conductors that lead to the coil, they certainly aren't carrying ten K.W."

DR. ARCOT slowly rotated the rheostat. There was a slight hum from the coil; then it was gone. There seemed to be no result. He rotated it a bit more; there was a slight draught in the room apparently, but he could see no startling results, so he rotated the rheostat considerably more. This time there was absolutely no doubt as to the results. There was a roar like a fifty-foot wind tunnel, and a mighty blast of cold air swept out of that coil like a six-inch model of a Kansas cyclone. Every loose piece of paper in the laboratory was driving madly before the blast of air that had suddenly kept out. Dr. Arcot was forced back as by a giant hand, but in falling back his head was lifted from the relay switch, and with a thud it had opened the circuit. In an instant all the noise was gone, and only a slight drifting of the air in the room told of the blast that had stirred it up so.

The astonished physician came forward and looked at it a moment in silence, while each of the other men watched him. Finally he turned to his son, who was smiling at him with a bit of a twinkle in his eye.

"Dad, I think you have 'loaded the die' in a way that is even more lucrative than any other method ever invented? If the principle of this machine is what I think it is, you have certainly solved the secret of a sufficiently absorbing area for a solar engine."

"Well," remarked the elder Morcy, shivering a bit in the chill air of the room, "loaded dice have long been noted for their ability to make money, but I don't see how that explains that working model of an Arctic tornado. Here—it is still too cold in here. I think he will need considerable area for heat absorption from the sun, for that engine certainly does cool things down! What is the secret?"

"The principle is easy enough, but I had considerable difficulty with the application. I think it is going to be rather important though—"

"Rather important," broke in the inventor's father. "I should think it will be considerably more than that! It is the biggest thing since the electric dynamo! It puts airplanes in the junk heap! It means a new era in power generation. It makes it certain that we will never have to worry about power! It will make interplanetary travel not only possible, but commercially economical."

"Dad seems to think it is a marvelous machine! But, seriously, I believe it will antiquate all types of airplanes. It is a direct utilization of the energy that the sun is kindly supplying. For a good many years now men have been trying to find out how to release the energy of atoms, or more powerful yet, the energy of constitution of water. It always reminded me of experimenting with fire on a pile of gunpowder. Of course you could stand there holding the match quite safely, but if someone burned his fingers and dropped the match—"

"But why do it at all? The sun is doing it already, and on a scale so gargantuan that we could never hope nor desire to approach it. Three million tons of matter go into that colossal furnace every second of time, and out of that comes two and a half trillion ergs of energy.* With a total of two and a half million billion billion billions of ergs to draw on, man will have nothing to worry about for a good many years to come! That represents a flood of power water than man could comprehend! It would fuse the earth so quickly, you wouldn't have a chance to worry about the hot weather! Why try to release any more energy? We have all that to use; we may as well tap that vast ocean of power.

"We have been doing that to an extent. Plants have done it for countless ages and more recently man has imitated by absorbing the power from the ocean's heat. But I would hate to estimate their efficiency. The solar engines developed so far are more efficient, of course; they run as high as thirty per cent, but as Dad says, they are tremendously bulky, only diaphanes can use them, and then they are effective only during the day. Dad has told you we need a larger heat absorbing area, and also, if it is going to work during the night, we must have some means of storing the heat energy to use after sunset. Now I think the earth would make a very nice storage basin; it certainly has a very comfortable area. And furthermore, it has a nice thick blanket of air and water that hold a tremendous amount of heat for night use. But it has always been a little hard to use that energy as we wish, though it is all there—more than we can use. But just try and get that energy out! Just think of the terrific amount of power there is stored in the millions of tons of water on the earth. There is only one thing that prevents us getting it out, the law of probability. That's why Dad mentioned loaded dice, for dice, as you know, are the classical example of probability when they aren't loaded. Once they are loaded, the law still holds, but the conditions are now so changed that it will make the problem quite different. Sell the law books, I'll admit that dice always seem to show the wrong face, but with a very great number of trials each face will show an equal number of times. The more trials you make, the more nearly does this approach to exactitude. Similarly there are many other illustrations of the law of probability. If you take an infinite number of chances, it always works out, but if you take any finite number of chances, it won't.

"The ideal case of an infinite number of chances is very nearly approached in one instance.

"Molecules in matter which has any heat at all, are moving rapidly, colliding, rebounding, and moving off. There are immense numbers of molecules in the tiniest grain of dust your eye can see. When you consider the conditions in a liter of helium gas in a container, you can consider that there are an infinite number of mole-

cules in it, to all practical purposes. In it, then, there is an equal chance for any molecule to go in any one direction, and the chances are that there is an equal number of molecules going in each direction. Thus we have our helium gas composed of a tremendous number of molecules, each dashing along at several miles a second, and an equal number dashing in the opposite direction at an equal speed. They are so thickly packed in there, that none of them can go very far before it runs into another molecule and bounces off in a new direction. But there is a chance that all the molecules should happen to move in the same direction at the same time. How good is this chance? One of the old physicists of Einstein's time, a man named Eddington, expressed it very well when he said:

"If an army of monkeys were playing on typewriters they might write all the books in the British Museum. The chance of their doing so is decidedly more favorable than the chance that all the molecules in a liter of gas should move in the same direction at the same time."

The very improbability of this chance is the thing that is making our problem appear impossible.

"But similarly it would be improbable—impossible according to the law of chance—to throw a string of aces indefinitely, or that one should deal a deck of cards and always deal thirteen of a kind in each hand. It is impossible—unless some other force influences the happening. If the dice have little bits of iridium stuck under the six spots, they will throw aces. If the cards are stacked, they will always deal thirteen of a kind. Chance makes it impossible to have all the molecules of gas move in the same direction at the same time—unless we stack the chances. If we can find some way to influence them, they may do so.

"What would happen to a metal bar if all the molecules in it decided to move in the same direction at the same time? Their best motion is normally carrying them about at a rate of several miles a second, and if now we have them all go one way, the entire bar must move in that direction, and it will start off at a velocity as great as the velocity of the individual molecules. But now, if we attach the bar to a heavy car, it will try to start off, but will be forced to drag the car with it, and so will not be able to have its molecules moving at the same rate. They will be slowed down in starting the mass of the car. But slow molecules have a definite physical significance, molecules move because of temperature, and lack of motion means lack of heat. These molecules that have been slowed down are then cold; they will absorb heat from the air about them, and since the molecule of hydrogen gas at room temperature is moving at about seven miles a second, when the molecules of the confined gas in our car, or the molecules of the metal bar are slowed down to but a few hundred miles an hour, their temperature drops to some hundreds of degrees below zero, and they absorb energy very rapidly, for the greater the difference in temperature, the greater the rate of heat absorption. Of course, in running our machine we must exercise caution, for the bar will try to start off at the full speed instantly, and fasten or not, that is the speed it will go unless its power is applied gradually.

"In practice I think it will be best to use helium in a

*72,900,000,000,000,000,000,000,000,000 = 2.5 calories.

copper container, since helium has a very low freezing point, and having a very light molecule, it goes at very high speeds when at room temperature. The copper will carry the heat to it better than any other metal, and that will permit the use of absorbing fins.

"We will be able to accelerate the car very rapidly to a speed of several miles a second at very high altitudes no doubt, and as we will be able to use a perfectly enclosed streamlined car, we will be able to get tremendous speeds. We will need no wings, of course, for by just putting a small unit pointed vertically, we will be able to support the car in the air. It will make possible a machine that will be able to fly in reverse, and so come to a quick stop. It will steer us or it will supply us with electrical power, for we mostly have to put a series of small metal bars about the circumference of the generator, and get a tremendously powerful engine. For ground cars, whose speeds of over one hundred and fifty miles an hour are impractical, we will use a metal bar, so that it is so much more directional, and less subject to gas leaks and failures, though there will be little chance of either in a welded inch-thick copper power unit.

"But for our present need, it means a tremendously powerful engine, that we can make invisible.

"I believe you can guess the source of that breeze we had there? It would make a great device for cooling and ventilating theaters and apartments!"

"Bill Arcot," began Morry, "I would like to be able to use that invention. I know enough of the economics of the thing, if not enough of the science, to know that the apparatus before us is absolutely invaluable. I could not offer to buy the rights on it, but I want to use it if you will let me. It means a new thing in transcontinental airplanes! Fuller, I want you to help Arcot with his problem for the ship to chase the Pirate. I will give you the contract to design the new airplanes. It will cost us billions to get these new machines out, but there will be no fuel bills, no oil bills, and the cost of operation will be negligible. Nothing but the Arcot short wave tubes to buy—and each one is good for twenty-five thousand hours service!"

"You will get the rights on this if you want them naturally," said Arcot. "You are maintaining these laboratories for me, and your son here helped me work it out. But if Fuller can move over here tomorrow, it will help things a lot. Also I would like to have some of your best special mechanics to make the necessary machines, and to start the power units."

"Bill," replied Morry, "you know that these labs are yours, and anything developed in them is yours, and that Dick is officially one of your employes. I will have the man here tomorrow. Do you want to keep this invention secret?"

"Why I only did some mathematics. But I do think it would be best to keep it a secret, because if the Pirate hears about it, he may get cautious and quit his work," Dick pointed out.

"I hadn't particularly intended to keep it a secret, but I guess you are right, Dick."

EARLY the next morning Fuller moved his materials over to the laboratory, and set up his table for work. Then, with the aid of Arcot and Morry, the design of the new machine was begun.

"First, let's get some idea of the most advisable shape," Fuller said. "We will want a streamlined shape; roughly

speaking, a cylindrical shape modified to fit the special uses to which it will be put. You no doubt have more of the general plan in mind, Arcot. Suppose you sketch it for us."

"Well, I thought it would be best to design it also as an experimental ship. We don't know much about this yet, and we have to work it out. You will have plenty of fun figuring out strains in this machine, so let's be safe and use a factor of safety of 5. That will also give us a heavier machine to do the testing with."

"In the first place, it must be proof against the Pirate's gas, for we won't be following the regular lanes with instruments to guide us safely, if we go out. I have thought that over, and I think that the best system is just what we used in the sample bottles—a vacuum. His gas is stopped by nothing, so to speak, but there is no substance that will stop it! It will no doubt penetrate the outer shell, but on reaching the vacuum, it will tend to stay there, between the inner and outer walls. Here it will tend to collect, since it will be fighting air pressure in its attempts to go either in or out. The pressure inside will force it back, and the pressure outside will force it in. If we did not pump it out, it would soon build up pressure enough to penetrate the inner wall. Now, since the stuff can leak through any material, what kind of a pump shall we use? It won't be pushed by a piston, for it will leak through either the cylinder walls or the piston. A centrifugal pump would be equally ineffective. The obvious solution is a mercury vapor pump, which will, of course, take it out, and keep a high vacuum, the difficulty being that that kind of a pump has too low a volume of rating. We never would make any progress. The thing would be impossible but for our new machine. With it we can just have a number of openings in the wall of the outer shell and set in them, one of these molecular motion detectors, and direct the molecules out! They can't come in through it, and they will tend to go out. That will protect us from the Pirate's gas.

"But now comes another difficulty. If we protect ourselves against the Pirate's gas by a vacuum, we must remember that our vacuum is an equally good protection against heat! Since our generator is intended to run on heat energy, it will be rather chilly inside if we don't remedy that. Of course, our power units will be placed outside, where the blast of air will warm them, but we really won't have a very good streamlining effect if we hang a big electric generator outside. The solution is obvious—if we can't bring the generator to the air, we must bring the air to it. We will have all the power equipment in this room here in the back, and the control room up in front, here. The relays for controlling will be back here, so we can control electrically the operation of the power equipment from our warm, gas-tight room. If it gets too warm in there, we can cool it by using a little of the heat to help accelerate the ship. If it is too cold, we can turn on an electric heater run by the generator. The air for the generator can come in through a small sort of scoop on top, and leave through a small opening in the rear. The vacuum at the tail will assure us a very rapid circulation, even if the centrifugal pump action of the enclosed generator isn't enough.

"For experimental purposes we will want the generator to be greatly over power so that we can make tests over a greater range. I don't believe we will need more than one hundred kilowatts altogether, but we should install

about a thousand, for convenience—A.C., of course, to we can send it through transformers. We will need batteries in the keel for starting the generator. Once the speed is high enough, it will be self-supporting, but it can have a small auxiliary D.C. machine to recharge the batteries and to run the relays. About ten kilowatts will do there.

"But let's begin making actual figures on this."

For the rest of the day the three men were working on the general plan of the new ship, trying to calculate the strengths needed, supplementing mathematics with actual experiments with the machines on hand. It was decided to put the batteries inside the main control room, lest they freeze at extreme altitudes.

It would be two days before they had finished. The calculating machines were busy continuously, for here there were few rules that experience could give them. They were developing something entirely new, and though they had as a designing staff three of the foremost mathematicians in the world it was a problem that tested them to the utmost.

By the evening of the first day, however, they had been able to give the finished designs for the power units to the mechanics who were to make them. The order for the storage battery and the standard electrical equipment had been placed at once. By the time they had completed the drawings for the main castings, the materials were already being assembled in a little private camp that Morcy owned, up in the hills of Vermont. The giant freight helicopters could land readily in the wide field that had been cleared on the small plateau, in the center of which nestled a little blue lake and a winding trout brook.

The mechanics and electrical engineers had been sent up there already—officially on vacation. The entire program could be carried out without attracting the least attention, for such orders from the great Transcontinental lines were so frequent that no importance was attached to them.

Four days after the final plans had been completed the lot of the supplies were being assembled in the portable metal shed that was to house the completed machine. The shining tungsten-steel alloy frame members were rapidly being welded in place by the cathode ray welding machines in the hands of skilled artisans.

Already at the other end of the ship the generator had been arranged for use with the molecular motion power units. The many power units to drive and support the ship were finished and waiting instalment as the party quit work on that fourth evening. They would be installed on the frame in the morning, and the generator would be hoisted into place with the small portable crane. The storage batteries were connected up, and in place in the hull. The great fused quartz windows were resting in their cases on one side of the room, waiting the complete application of the steel alloy plates. They were to be over an inch thick, an unnecessary thickness, perhaps, but they had no need to economize weight, as witnessed by their choice of steel instead of light metal alloys throughout the construction.

The three men had arrived late that afternoon in a small helicopter, and had gone directly to the shops to see what progress had been made. They had been forced to remain in New York to supervise the shipment of the necessary supplies to the camp site, and since no trouble was anticipated in the making of the steel

framework, they had not felt it necessary to come. But now they would be able to help, and to superintend the more delicate work.

"She is shaping up nicely, isn't she?" Arret was gazing at the rapidly rounding frame with a critical eye. Unhindered as they were by the traditional shapes, by wings or other protruberances, they had been able to design a machine of striking beauty. The ship was to be left in the natural shiny metal, the only protection being a coat of the newly discovered "passivity paint"—a liquid chemical that could be brushed or sprayed on iron, chromium, nickel or cobalt alloys rendering them passive to practically all chemical agents. Iron can be rendered "passive" by treating in very concentrated nitric acid, the result being a piece of iron that is unattacked by nitric acid, sulphuric, or even aqua regia, which will dissolve gold and platinum, and to a certain extent, iridium. This new "paint" produced a much more permanent passivity in iron, leaving the iron or steel as shiny as ever, but overcoat with a beautiful iridescence, and immune to the most powerful reagents.

THE three men walked around the rapidly growing hull, and looked with excited interest at the heavy welded joints and the great beams. The ship seemed capable of withstanding a fall of several hundred feet with little damage. The location of the power units was plainly visible, and easily recognized, for at each point there came together four or five great beams, welded into one great mass of tough metal, and in it there were set the heavy tungsten bolts that would hold the units in place. Stronger than steel, tungsten had a great advantage here, for its long fibrous structure made it peculiarly resistant to shearing strains.

They inspected each joint minutely for signs of flaws, using a small portable X-ray fluoroscope to see the interior of the metal. Each joint seemed perfect. They retired, satisfied everything was ready for the work of the next day.

The morning began early with a long swim in the lake, and a hearty breakfast of country farm produce, a thing rare to these city-bred men. Then the work on the great framework was continued, and that day saw the power units bolted in place, removable if change was thought advisable. Each power unit was equipped with long streamlined copper fins lying close to the rounded hull, that they might absorb heat more rapidly.

Day by day the structure neared completion, and, with the large crew of specially skilled workers, the machine was practically complete within a week. Only the instruments remained to be installed. Then at last even these had been put in place, and with the aid of Fuller, Morcy, junior, and his own father, Arret had connected their many complicated circuits.

"Son," remarked Arret's father, looking critically at the great switchboard, with its maze of connections, its many rheostats and controls, and its heavy busbar connectors behind it, "any man who can keep his eye on those instruments must be a close relative of the insects with their many-faceted eyes. I certainly hope you have a good-sized crew to operate all those controls! We have spent two days of hard work getting all those circuits together, and I'll admit that some of them still have me lost. I don't see how you intend to watch all those instruments, and at the same time have any idea what's going on outside."

"Oh," laughed Arcot, junior, "these aren't intended for constant watching. They are merely to aid in efficiency tests and tests of different kinds. I will set the controls for ordinary work, but first I will have to experiment to determine at what values they will work best. I want to experiment with this machine so I can determine the necessary powers and the lowest factor of safety to use in building other machines. I want to use this as a flying laboratory for the necessary experiments. The machine is very nearly completed now. All we need is the seats—they are to be special air-inflated gyroscopically controlled seats, to make it impossible for a sudden twist of the ship to put the strain in the wrong direction. Of course the main gyroscopes will balance the ship laterally, horizontally and vertically, but each chair will have a separate gyroscope mounting for safety. I want you to remember that this is an experimental model, and not the finished ship. No machine, in all the history of invention, was truly perfected by any one man. I have had the thoughts of four men helping me on this, and the practical suggestions of experienced mechanics, the ideas of old workmen, and I believe that the machine will function perfectly, but I want to be able to watch the working of every smallest piece of the structure.

"I will practice the manipulation of the machine for at least four days before I try to chase the Pirate. I would ordinarily recommend the greatest haste, but the man has eyes close to ten millions now, and is still at it. That would not be done by anyone in his right mind. Just think, the War Department thought that you so important that they have obtained a pardon for him on condition they be permitted to have the secret of it. They demand the return of the money, and I have no doubt he has it. I am firmly convinced that he is a leptomaniac. I doubt greatly if he will stop taking money before he is caught. Therefore it will be safe to wait until we can be sure of our ability to operate the machine smoothly. To start out without practice when we are operating such a tremendously powerful airship would be suicidal. Also, I am having some of those tool-makers make up a special type of molecular motion machine for use as a machine gun. The bullets are steel, about three inches long, and as thick as my thumb. They will be perfectly streamlined, except for a little stabilizer at the tail, to act as a guide. They will not spin as a rifle bullet does, and so there will be no gyroscopic effect to hold them nose on, but the streamlining and the stabilizer will keep them on their course. I expect them to be able to walk right through many grades of armour plate, since they will have a velocity of over four miles a second.

"They will be fed in at the rate of about two hundred a minute—faster if I wish, and started by a small spring. They will instantly come into the field of a powerful molecular motion-director, and will at once be shot out with terrific speed. It will be the first rifle ever made that could shoot bullets absolutely parallel to the ground. The bullets would go on forever without hitting the earth if I shot them when up above the sea, for they will follow an orbit! At five miles a second, a thing is in equilibrium between centrifugal force tending to throw it away from the earth, and gravity tending to pull it down, as you know. It will be accurate at all ranges, allowing for wind-carriage only.

"But that is all we can do today. The guns will be

mounted outside, and controlled electrically, and the chairs will be installed tomorrow. By the day after tomorrow at eight A. M. we ought to take off!"

Later that evening they strolled open for a last swim, for strong moonlight was flooding the Vermont countryside.

As they returned from the swim, Morey noticed that Arcot was standing off to one side looking up at the moon.

"Thinking of visiting the moon, Dick? I wonder if you could?"

"I don't know, Bill—but—it isn't impossible now?"

The work the next day was rushed to completion far earlier than Arcot had dared to hope. All the men had been kept isolated at the farm, but they accidentally spread the news of the new machine. It was with excited interest that they helped the machine to completion. The guns had not been mounted as yet, but that could wait. Three-thirty of the afternoon found the machine resting in the great construction shed, completely equipped and ready to fly!

"Dick," said Morey as he strode up to him after testing the last of the gyroscopic seats, "she's ready to fly! I certainly want to get her going—it is only three-thirty, and we can go around to the sunlight part of the world when it gets dark at the speeds we can travel. Let's test her out now?"

"I have sent for a U. S. Air Inspector. As soon as he comes we can start. I will have to get an 'X' license indication on her now. He will go with us to test it. There will be room for three other people aboard, and I think that you and Dad and I will be the logical passengers. Look, there is a Government helicopter coming. I guess we will start soon. Tell the men to get the blocks out from under it and tow it out on the rollers. Get it at least ten feet beyond the end of the hangar. We will start it straight up, and climb up to at least five miles, where we will have room to make mistakes safely. When we learn to operate this thing, we want to remember that the machine is infinitely more powerful than anything either of us ever led our hands on before. While you are tending to that, I will see if I can induce the Air Inspector to take a trip with us."

Half an hour later the machine had been rolled entirely out of the shed. The great rollers sank deep into the soft turf of the soil as the two-hundred-ton burden pressed down on them.

THE great machine was a thing of beauty as it rested in the bright sunlight. For the first time the machine was out of the dimness of the construction shed, and its true features and lines were apparent. The four men who were to ride in it on its maiden voyage were off to one side looking at the great gleaming metal hull. The long sweeping lines of the sides told a story of perfect streamlining, and implied high speed, even when it rested thus inert on the ground. The bright, slightly iridescent steel hull shone in silvery contrast to the gleaming copper of the power wires' heat-absorption fins. The great clear windows in the nose and the low, streamlined air intake for the generator seemed only to accentuate the lines of the graceful machine.

"Lord, she's beautiful, isn't she, Dick?" exclaimed Morey, looking at the glistening hull.

"Well, she did shape up nicely on paper, too, didn't she. Oh, Fuller, come and look at your masterpiece.

It is even better looking than we thought, now the copper has added color to it. Doesn't she look fast? I wish we didn't need physicists so badly on this trip, so you could go on the first side with us."

"Oh, that's all right, Dick, I know the number of instruments in there, and I realize they will mean a lot of work this trip. I wish you all luck. The honor of having designed the first ship like that, the first heavier than air ship that ever flew without wings or helicopter propellers—that is something to remember. And I think it is one of the most beautiful that ever flew, too."

"Well, Dick," said his father, "let's get under way. I am anxious for the test."

The four men entered the ship and were strapped in the gyroscopic seats. One by one they reported ready.

"Officer, I want to explain that these seats may seem to be a bit more active than one generally expects a seat to be, but in this experimental machine, I have provided all the safety devices I could think of. The ship itself won't fall, of that I am sure, but the power is so great it might well prove fatal to us if we are not in a position to resist the forces. You know all too well the effect of sharp turns at high speed and the results of the centrifugal force. This machine can develop such tremendous power that I have to make provision for it. You notice that my controls and the instruments are mounted on the arm of the chair really; that permits me to maintain complete control of the ship at all times, and still permits my chair to remain perpendicular to the forces. The gyroscopes in the base here cause the entire chair to remain stable if the ship rolls, but the chair can continue to revolve about this bearing here so that we will not be forced out of our seats. We will always be 'sitting up' and never lying down or leaning back, as we would seem to be, if the chairs did not vary in position with the forces. The air infusion makes them more comfortable. I sincerely hope you will find the machine safe enough for a house. I know the necessary maneuvers required by law, but I am not used to handling this ship, and I will have to take it straight up first. There is no one in the vicinity to be hurt by any accidents, so with your permission, I will start."

"All right, Dr. Arest. If you and your father are willing to try it, I am," replied the Air Inspector.

"Ready, Engineer?" asked Arest.

"Ready, Pilot!" replied Morcy.

"All right—just keep your eye on the meters, Dad, as I turn on the system. If the instruments back there don't take care of everything, and you see one flash over the red mark—yank open the main circuit. I'll call out what to watch as I turn these on."

"I am ready, Son."

"Main gyroscopes!" There was a low buzz, a clucking of relays in the rear compartment, and then a low hum that quickly ran up the scale. "Main generators!" Again the clucking switch, and the relays thudding into action, again the rising hum. "Seat-gyroscopes." The low click was succeeded by a quick action that died in inaudible high frequency as the separate seat-gyroscopes took up their work. "Main power take bank!" The low hum of the generator behind elongated to a momentary roar as the relays threw the load on. In a moment the automatic controls had brought it up to speed.

"Everything is working perfectly so far. Are we ready to start now, Son?"

"Main vertical power units!" The great ship trembled

throughout its length as the lift of the power units began to pull on it. A special instrument had been rigged temporarily on the floor beside Arest, that he might be able to judge the lift of his power units; it registered the apparent weight of the ship. It had read two hundred. Now all eyes were fixed on it, as the pointer dropped quickly to 150—100—75—50—40—20—10—there was a click and the instrument flipped back to 300—it was registering in pounds now! Then the needle was at zero, and the mighty structure floated into the air, slowly moving down the field as a house carried it along the ground. Now the men outside saw it rise swiftly into the sky, straight toward the blue vault of heaven. In two or three minutes it was disappearing. The glowering ship shrank to a tiny point of light; then it was gone! It must have been rising at fully three hundred miles an hour! The fastest racing helicopters seldom rose faster than that! The record was three hundred and thirty-two miles an hour!

To the men in the car there had been a tremendous increase in weight that had forced them into the air cushions like leaden masses. Then the ground was dropping away with a speed that made them look in amazement. The horse, the construction shed, the lake, all seemed contracting beneath them. So quickly were they rising that they had not had time to adjust their mental attitude. To them all the world seemed shrinking about them. Now they were at a tremendous height, over twenty miles they had risen into the atmosphere; the air about them was so thin that the sky seemed black, the stars glaced out in cold, unswerving glory, while the great fires of the sun seemed reaching out into space like mighty arms reaching—reaching to draw back to the parent body the masses of the whirling planets. About it, in far flung streamers of cold fire the mighty reduced light stretched out into space, an Aurora on a titanic scale. For a moment they hung there, while they made readings of the asters.

"I never began to let out the power of this thing. When these are made commercially, we will have to use about one horsepower generators in them, or people will try to see how fast it will go and will die of the terrific acceleration and leave the car, like some vast bullet, streaking on through the sky at ever greater speeds, till at last it throws itself off into space. This would make it a nuisance as well as a blessing. I will have to be careful myself!"

FOR several minutes the machine was tried out at this height, testing various settings of the instruments. It was definitely proven that the values that Arest and Morcy had assigned from purely theoretical calculations were correct to within one-tenth of one per cent. The power absorbed by the machine they knew and had calculated, but the terrific power of the driving units was far beyond their expectations. They had estimated the power of the machine as great, but even they had been unable to calculate the power released.

"Well, now we're off for some horizontal maneuvers. I believe I have satisfactorily demonstrated the machine's ability to hold itself in the air, to climb at a safe rate to a considerable altitude. The air pressure control's seems to be working perfectly. I am now going to give the necessary proof of ability to maintain traffic speed—I believe they now require over two hundred miles an hour. I will accelerate it at the greatest safe value."

Suddenly the seats swung beneath them a bit; then, as the ship shot forward with ever greater speed, ever greater acceleration, it seemed that it turned and headed upward, although they knew that the main stabilizing gyroscopes were holding it level. The seats swung beneath them as the acceleration became greater and greater. In a moment the ship was headed out over the Atlantic at a speed no rifle bullet had ever known. Faster and faster the plane stretched along, until it became an almost invisible blur. The radio speedometer needle pushed farther and farther over as the speed increased to unknown values. Before they left the North American shoreline they were going over one mile a second. The speed increased terrifically, as the men labored under weights of seven to eight hundred pounds apiece. They were over the middle of the Atlantic before Aroet gradually shut off the acceleration, letting the seats drop back into position. Once more they were able to judge up and down with some definite standard.

They had been able to watch the sun sink rapidly toward the horizon. It was night on the water rolling far beneath, but the sun's rays still reached them where they were.

"What speed did we reach, Dr. Aroet—look—there is the coast of Europe. Watch it loom toward us. How fast are we going?" asked the Air Inspector.

"The air resistance is slowing us down. We were traveling at the rate of three miles a second before I decreased the acceleration. Now it has fallen to two and a half!" Dr. Aroet answered.

"That decidedly checks off the speed requirement. But how do you measure such terrific speed? You have no means of using the air blast at that rate. What is the system?"

"I had to develop one—but it is only accurate to about one part in a hundred now. That's near enough for our work. For ordinary speeds we use the automatically barometrically corrected airspeedometer, but this piece of apparatus depends on the use of radio. You do not change the speed of light no matter how fast the source is moving, but for that reason, if the source is moving toward you, the waves get packed in closer together than they would ordinarily. The same is true of a radio wave. I send out a radio wave from a very small set in the nose of the ship, and pick it up by a set in the rear of the ship. By means of the usual velocity measuring apparatus I find the velocity of the wave as picked up by the set in the rear. That is electrically registered here, but instead of registering it as 186,288 miles per second, with the appropriate number of tenths and hundredths of a mile per second, it subtracts the discovered value from the correct value, the difference being our speed. I hope to get it more accurate in the future, but it is the only serviceable means at hand now.

"I'm going to try to see what the ultimate ceiling of this machine is. Remember, it must have a ceiling, since it depends on the operation of the generator to operate the power units. This, in turn, depends on the heat of air. Of course the main power units, being outside in the sun's rays, are warmed to an extent by them. I don't know how high it will work."

The ship was put into a vertical climb, and steadily the great machine rose, at a low rate but they reached the mark, and have the wrong result. Soon, however, the great generator behind began to slow down, the automatic controls could not bring it up to a sufficient

speed. The readings of the instruments were dropping rapidly. The temperature of the exceedingly tenuous air outside was so close to absolute zero that it was nearly impossible to get sufficient energy from it.

"Get up some forward speed so that you will have the aid of the air scoop to force the air in faster."

"Right, Morey." Aroet slowly applied the power to the forward propulsion units. Slowly they took hold, and the ship began to move forward again. The increase was apparent at once. The machine quickly gained power and she was rising again. But at last, at a height of fifty-one miles, the ship would rise no farther. The cold of the cabin became unbearable, for every kilowatt of power that the generator could get from the air outside was needed to run the power units. The air, too, was getting bad, for the pumps could not supply enough, and the oxygen tanks had not been carried on this trip. Now they were dropping, dropping, the machine was held steady by the gyroscopes, but she was dropping freely, the power of the generator being used to warm the cabin once more. But the machine had fifty miles to fall, and as the air resistance of the denser air mounted, they could begin to feel the weight return as the air slowed them down in their fall.

"You've passed, but for the moment, sir! The required altitude was passed so long ago—why are we still some miles above it, I guess! How fast are we falling?" The Air Inspector was decidedly impressed.

"I can't tell unless I point the nose of the ship down, for the apparatus works only in the direction in which the ship is pointed. Hold on, everyone, I am going to start using some power to stop us."

It was night when they returned to the little field in Vermont. They had established a new record in every form of aeronautical achievement except endurance! The altitude record, the speed record, the speed of climb, the acceleration record—all that Aroet could think of had been passed. Now the ship was coming to dock for the night. In the morning it would be out again. But now Aroet was sufficiently expert with the controls to maneuver the ship safely into the hangar. They finally solved the wind difficulty by decreasing the weight of the ship to about fifty pounds, so enabling the three men to carry it into the hangar!

THE next two days were devoted to careful tests of the power factors of the machine, the best operating frequency, the most efficient altitude of operation, and so many other tests as they had time for. Each of the three younger men took turns operating it, but so great were the strains of the sudden acceleration, that Aroet, senior, decided it would be wisest to stay on the ground and watch.

In the mean time reports of the *Pilot* became fewer and fewer as less and less money was shipped by air.

Aroet spent four days practicing the manipulation of the machine, for though it handled far more readily than any other machine he had ever controlled, there was the danger of turning on too much power under the stress of sudden excitement. Yet he could not afford to lower the limit of available power, for there must be a margin of at least 32 feet per second to cover the effects of gravity.

If they were flying against it, they would need 64 feet per second per second more acceleration than if they were flying with it. The "load" of the ship could be

gotten by practice only. He must make his actions instinctively in emergencies, and the battle with the Pirate was apt to be a long series of emergencies, for certainly the Pirate had some weapons other than his gas. No standard machine gun could throw a bullet through the inch-thick armor-plate walls of the machine, and as these were double, there was slight chance of any known ship carrying a gun heavy enough to pierce these double walls, which were yet light enough to land on the Transcontinental plane without disturbing its equilibrium.

The night before, Arcot had sailed the ship down and alighted on the roof of Morcy senior's apartment, leaving enough power on to reduce the weight to but ten tons, but it fell through the roof, while he went down to see the President of the Lines about some "bait" for the Pirate.

"Send some cash along," said Arcot, when he saw Morcy, Sr. "Say a quarter of a million, make it more or less public knowledge, and jalk it up so that the Pirate may think there is a real haul on board. I am going to accompany the plane at a height of about a quarter of a mile above. I will try to locate him from there by means of the radio disturbance locator, and if I have my apparatus on, I naturally can't locate him. I hope he won't be scared away—but I rather believe he won't. At any rate, you won't lose on the try!"

A GAIN Morcy and Arcot were looking at the great Jersey aerodrome, out on the great fields that had been broad marshes centuries before. Now they had been filled in, and stretched for miles, a great landing field, close to the great city across the river.

The men in the air above were watching the field below, hanging inert, a silent dot of glistening metal, high in the deep velvet of the purple sky, for fifteen miles of air separated them from the Transcontinental machine below. Now they saw through their field-glasses that the great machine was lumbering slowly across the field, gaining momentum as it headed westward into the breeze on the take-off. Then it seemed to be barely clearing the great skyscrapers that towered twenty-four hundred feet into the air, arching over four or six city blocks. From this height they were toys made of colored paper, soft colors that glistened in the hot noon sun, and around and about them were whirling lines of flashing, moving helicopters, the individual lost in the mass of the million or so swiftly moving machines, for only the higher, steady moving levels of traffic were visible to them. Below these they knew were other and still other levels of machines, hanging motionless or creeping along at thirty or forty miles an hour, rocking slightly, despite the gyroscopic stabilizers as the terrific air-wash of thousands of whirling blades hit them, varying each moment as the crowded traffic moved.

"Just look at those cars in the traffic below there! Thousands and thousands coming back into the city after going home to lunch—and every day the number of helicopters is increasing! If it hadn't been for your invention of this machine, they would have been impossible soon. The airblast in the cities is unbearable now, and getting worse all the time. Many machines can't get enough power to hold themselves up at the middle levels; there is a down current of over one hundred miles an hour at the 400-foot level in downtown New York. It takes a racer to climb fast there!

could never live in that huge air-pocket. I have to drive in through there. I'm always afraid that somebody with an old worn-out bus will have stabilizer failure, and it will work havoc with hundreds below." Morcy was a skilled pilot, and rational, as few others did, the dangers of that downward ambient that the countless whirling blades maintained in a constant roar of air. The office buildings now had double walls, with thick layers of sound-absorbing materials, to stop the roar of the cyclone blast that continued almost unabated twelve hours a day.

"Oh, I don't know about that, Morcy," replied Arcot. "This thing isn't all to the good. Remember that if we had about ten million machines lying in the air of New York City on the heat contained, there would be a noticeable fall in the temperature. It would undoubtedly drop to a temperature that would produce an Arctic climate year in and year out. You know, though, how unbearably hot it gets in the City by noon, even on the coldest winter days, due to the heating effect of the air friction of all the thousands of blades. I have known the temperature of the air to go up fifty degrees, due to the heat of the engines and the friction of the blades. The solution of the thing is obvious. There will be a sort of balance between the two types of machines. It will be a terrific economical problem, but at the same time it will solve the problem of the great companies who have been fermenting grain machines for alcohol. The ester bean growers are also going to bring down their prices a lot when this machine kills the market. They will also be more anxious to extract the carbon from the cornstalks for reducing ores of iron and of other metals. It will no doubt have to be worked out eventually at any rate." As the ship flew high above the Transcontinental plane, the men discussed the economic values of the different applications of Arcot's discoveries from the huge power stations they could make, to the cooling and ventilating of houses.

"Arcot, you mentioned the cooling effect on New York City; with the millions on millions of these machines that there will be, with huge power plants, with a thousand other different applications in use, will not the terrific drain of energy from the air cause the whole world to become a little cooler?" asked Fuller.

"I doubt it," said Arcot slowly. "I have thought of that myself. Remember that most of the energy we use eventually ends up as heat anyway. The light we use turn the electricity to light, whence it is radiated to be absorbed by materials that convert it into heat. Motors give off heat and mechanical energy. The propellers convert the mechanical energy to motion of the molecules of air—heat again. The forward drive of the airship is converted into heat through air-friction. Only the energy we store as chemical energy is maintained—and eventually that leaks back into the air. In return, just remember the countless of ergs of energy that the sun is giving off—true, we don't get more than an infinitesimal portion of that energy—but what we do get is more than enough for us. Power houses can be established very conveniently in the tropics, where they will cool the air, and the energy can be used to refine metals or to stabilize the carbon of carbon dioxide from the air. I understand from something Dad said last night that that is what he is working on now. He has devised a method for decarboxylating carbon dioxide in a solution in a compound Jackson worked out for him. That brings us to carbon,

the true starting point for any organic synthesis. With that we will have an unlimited supply of acetylene, the one indispensable hydro-carbon in modern synthesis. That means that the surplus heat of the tropics will find a use. Together with the weather control possible by the direction-control of great winds, we could set huge director tubes on top of mountains, and blow the winds in whatever direction best suited us, not the blown wind itself, but the vast volume of air it carried with it, would be able to cool the temperate zones in summer from the cold of the poles, and warm it in winter with the heat of the tropics. Similarly the tropics would, in this way, be cooled. Of course the control could not be perfect, but it would bring about a vast improvement. I think, however, that we will find this machine to be of great benefit. I don't think it will appreciably lower the mean temperature of the earth.

"And there is another thing it may make possible in the future—a thing that is hard to accept as a commercial proposition. We have sources of energy now, but we have no sources of materials that will last indefinitely. Copper is becoming more and more rare. Had it not been for the discoveries of the great copper fields of the Sahara and in Alaska, we would not have any now. Platinum is exhausted, and even iron is becoming more and more valuable, for low-grade iron ores cannot be worked. We are facing a shortage of metals. Aluminum, magnesium, calcium, and iron exist in vast quantities, but they are largely in low concentration ores. Do you realize that within the next two centuries we will be unable to maintain this civilization unless we get new sources of materials? History shows us civilization after civilization falling before the invading hordes of barbarians—men who were better equipped to fight for what they wanted. Within two centuries our civilization will be helpless for lack of essential metals. Iron can be gotten from the frames of the skyscrapers as they are replaced by little glass buildings. Glass, or silicon dioxide, practically constitutes a huge percentage of the earth's crust. Silicon represents 28% and oxygen over 47%, so in the available matter of the earth, two elements alone constitute more than three-quarters of the resources. Luckily, the next most abundant element, and the next few are metals, aluminum, iron, calcium, magnesium, sodium and potassium. (I am not certain about the order of calcium and magnesium.) Together, these total about 23%. That means that the first seven abundant elements constitute 98% of our available resources. All the other elements on earth do not total more than 2%! That means that, including the vast quantities of hydrogen, nitrogen, and all other non-metals, chlorine, sulphur, and even carbon, and many metals such as copper, lead, zinc, tin, silver, tungsten, molybdenum, beryllium—all the other 85 elements—total only two per cent! Every time I think of those figures it frightens me. Aluminum, iron, and magnesium are useful for our work. Calcium, sodium, potassium—are cannot use them; they are soft, and so active that they corrode rapidly in the air. In the 98% of the available matter of the earth, three elements are useful. In the two per cent be all our other materials, except glass. Well, it looks as if we had better start using glass a great deal more!

"But we have one other chance now. This civilization is doomed if we don't get more elements from some-where.

"The solution is—there are eight* planets in this solar system! Neptune and Uranus are each far vaster than Earth; they are utterly impossible for life as we know it, but a small colony might be established there to refine metals for the distant earth. We might be able to build night-closed cities. But first we could try the nearer planets—Mars, Venus, or some satellite such as our Moon. I pray that this machine will make it possible."

FOR some time they sat in silence in the machine as they swept along, high above the green plains of Indiana. Chicago lay like some monster jewel far off on the horizon to the right and ahead. Below them the huge bulk of the Transcontinental plane seemed a toy, five miles below, as it swung slowly across the fields—actually traveling over six hundred an hour. They too seemed almost motionless as the landscape swung slowly past beneath them. At last Morey spoke.

"You are right, Arnot. We will have to think of the interplanetary aspects of this some day. Oh, isn't that Chicago off there? We had better start the vacuum gas projector. And I will turn the radio disturbance indicator on to the general reception aerial till we see some signs of action."

The three men forgot the impending danger of the shortage of metals. There were a number of adjustments to make, and these were quickly completed, while the machine forged evenly, steadily ahead. The generator was adjusted to the maximum efficiency, the various tubes were tested separately, for though they were all new, and each good for twenty-five thousand hours, it would be inconvenient, to say the least, if one failed while they were in action. Each tested perfect, and though they could not hear the even hum of the generator behind them, due to the approximate vacuum at this altitude, they knew from the smooth functioning of the various relays that governed it as the loads on it varied, that it must be working perfectly, at something less than one-half maximum rating. There was a reassuringly large factor of safety in all parts of this machine, which was a good thing on an experimental machine, but left no factor of safety for Mr. Average Citizen's pocket book, if put on the commercial production in this form.

Steadily they flew on, waiting tensely for the first sign of a glow from the tiny neon tube indicator on the panel before Morey.

"This looks familiar, Dick," said Morey, looking about at the fields and the low line of the Blue mountains far off on the western horizon. "I think it was about here that we took our little nap in the 'Flying Wheel Chair,' as the papers called it. It would be about here—LOOK! It is about here! Get ready for action, Fuller. You're taking the machine gun, I'll work the invisibility disrupter, and Arnot will run the ship. Let's go!"

On the board before him the tiny neon tube flickered dimly, glowed for a moment like a piece of red-hot iron, then went out. In a moment it was glowing again, and then quickly its brilliance mounted till it was a line of crimson. Quickly Morey snugged the switch from the general radio disturbance detector to the beam receiver, that he might locate the machine exactly, the receiving set being arranged to pick up the signals emanating from points in the beam only, and the same control kept the projector of the invisibility disrupter in constant coordination, so that the sighting of the receiver automatically

*Nineteen, if they was willing, a sixth planet was discovered.

directed the disrupter beam at the same point. Quiddly the beam was scanning the sky below them, as it searched for the plane of the Pirate. It was fully a minute before the neon tube flashed into life once more. The pirate was flying just ahead of the big plane, very lightly gasping them. All around him were the Air Guardians, unaware that the enemy was so near. As the disrupter beam could be projected only about a mile, they would have to dive down on the enemy at once, and an instant later the great plane beneath them seemed to be rushing toward them at terrific speed.

The two radio beams were constantly kept focused on the plane of the Pirate. When they were about two miles from the two machines below them, the neon tube blazed up brilliantly as the energy of the two machines died. The Pirate was trying to maintain his invisibility, while the rapidly growing strength of the machine above was trying to batter it down, the resulting interference radiating a large amount of energy. The strength of Morcy's beam was growing at a tremendous rate, as the two machines approached at nearly three hundred miles an hour. In a moment the monitor connected with the disrupter beam began to rise so rapidly it seemed dangerous, for despite the ten-kilowatt set being used to project the beam, the resistance of the apparatus on board the pirate ship was amazing. Now, however, there was a rapidly solidifying cloud before them, as the interference of the beam Morcy was sending broke down the molecular oscillator that permitted the light to pass freely through the machine. Suddenly there was a circle of blue light about the shadow form, and a moment later the ionized air relapsed into normal condition as the pirate's apparatus broke down under the strain. At once Morcy shut off his apparatus, convinced from the suddenness that the pirate's apparatus had been blown out, the tubes unable to stand the strain of the larger tubes on board their machine. He glanced up to look at the pirate as he finished his job. He cried out in astonishment as Arcot called to him, "Morcy—look at him go!"

Morcy was too late to see him go. Already the plane had shot off with terrific speed. It had shot up and to their left, at a rate of climb that seemed unbelievable—except that the long trail of flaming gas told the story! The plane was propelled by rockets! The terrific acceleration carried it out of their range of vision in an instant, and as Arcot swung the ship to bring him again within the range of the windows, they gasped in astonishment, for already he was many miles away, a long trail of flaming gas marking his swift flight! There was a terrific wrench as Arcot threw on all the power he dared, then quickly leveled the machine out, following the pirate at lightning speed. He increased the acceleration further as the men grew accustomed to the force that weighed them down. Ahead of them the pirate was racing along, but quiddly now they were overhauling him, for his machine had wings of a sort! They produced a tremendous amount of head resistance at their present velocity, for already the traffic of the radio spectrometer had moved over to one mile a second. They were following the fleet plane ahead at the rate of 3600 miles an hour. The roar of the air outside was a tremendous wave of sound, yet to them, protected by the vacuum of the double walls, it was detectable only by the vibration of the car.

And naturally the rarefaction of the air operated to reduce the sound.

RAPIDLY the load of the pirate's machine was cut down, as their acceleration became greater. It seemed but a moment before he would be within range of their machine gun. Suddenly he roared down and shot for the ground, ten miles below, with the full speed of his machine. In an instant Arcot had swung his machine in a loop that held him close to the tail of the pirate. The swift maneuvers at this speed were a terrific strain on both men and machines—the acceleration seemed crushing them with the weight of four men, as Arcot followed the pirate in a wide loop to the right that ended in a straight climb, the power rocket ship standing on its tail, the rocket blast roaring out behind, a stream of fire a half mile long. It was climbing at a speed that would have distanced any other machine the world had ever seen, but the tenacious opponent behind him clung ever tighter to the tiny darting thing. He had released great clouds of his animation suspending gas. To his utter surprise, the ship behind had driven right through it, entirely unaffected! He, who knew most about the gas, had been unable to devise a material to stop it, a mask or a tank to store it, yet in some way these men had succeeded! And the hurtling, bullet-shaped machine behind! Like some miniature airship it was, but with a speed and an acceleration that put even his to shame! It could twist, turn, dive, rise and shoot off on the straight-away with more flashing speed than his machine displayed. Time and again he tried complicated maneuvers that strained him to the utmost, yet that machine always followed after him!

There was one thing to do. In outer space his rockets would support him. In a straight climb he shot up to the blazing sun above, out into space, while the sky around him grew black, and the stars shone in soken splendor around him. But he had eyes for only one thing, the shining car that was rising with more than equal speed behind him. He knew he must be climbing over two thousand miles an hour, yet the tracker came ever closer. Just out of sighting range for the machine gun now . . . in a moment . . . but, she was following!

The men in the machine behind on white-tipped, tense, as the whirling shocks of sudden turns at terrific speed twisted the gyroscopic seats around like peas in a rolling ball. Up, down, left, right, the darting machine ahead was twisting with unbelievable speed. Then suddenly the nose was pointed for the south again, and with a great column of flame shooting out behind him, he was heading straight toward space!

"If he gets there, I lose him, Morcy!" said Arcot. The terrific acceleration of the chugging car seemed to press them to their seats with a deadly weight. It was a labor to talk—but still the car ahead was shooting ahead—slowly they seemed to be overhauling him. Now that the velocities were perforce lowered by the effects of gravity, and the air resistance of the atmosphere was well nigh gone, only the acceleration that the human body could stand was considered. The man ahead was pushing his plane ahead with an acceleration that would have killed many men!

Slowly the acceleration of the machine was falling. Arcot pushed the control over to the last aspect, and felt the slight surge, as greater power rushed through the coils momentarily. Soon this was gone too, as the generator behind faltered. The driving power of the atmospheric heat was gone. More than sixty miles below them they could see the earth as a greenish brown surface,

slightly curved, and far to the east they could distinguish a silvery line of water! But they had no eyes but for the columns of shooting flames that represented the fleeing rider! Out in airless space now, he was safe from them. They could not follow. Aron turned the machine once more, parallel to the earth, watching the plane above through the roof window. Slowly the machine sank to the fifty-mile level, where there was just sufficient air to maintain it in efficient operation.

"Well, he beat us! But there is only one thing for us to do. He must hang there on his rockets till we leave, and we can hang here indefinitely, if we can only keep the cabin securely warm. He has no air to cool him, and he has the sun to warm him. The only thing that is wearing him right now is the heat of his rockets. But he can throw most of that out with the gases. Lord, that's some machine! The principle is easy to see. He uses his atomic hydrogen stored in the way he has, and thereby can store, in very little space, a gas which contains that yields 100,000 calories for every two grams. He can run a real machine on that! But eventually his rockets will give out, and down he will come, so we will just hang here beneath him and—what's not so fast—he isn't going to stay there, it seems; he is sagging his ship off a bit, and shooting along, so that, besides, holding himself up, he is making a little forward progress. We will have to follow! He is going to do some spooling, it seems! Well, we can keep up to him, at our level."

"Dick, no plane ever made before would have stood the terrific pulls and yanks that his plane got. It was soaring and twisting on the standard type air rockets, and what strain he had! That unique type of plane must be extremely strong. I never saw one shaped like his before, though—it is the obvious shape at that! It was just a huge triangular arrowhead! Did you ever see one like it?"

"Something like it, yes, and so have you. Don't you remember that as the development of the old paper gliders you used to throw around as a kid? It has the same shape, the triangular wings with the point at the head, except that he undoubtedly has a slight curve to the wings to increase the efficiency. I hope that man is only a dilettante, because he can be cured of that, and I can then have a new laboratory partner. He has some exceedingly intelligent ideas! His idea of copying the birds was good—except that he carried it too far. The idea of flying was good, but the birds have a method that man can't imitate. The birds have flapping wings, and their wings are shaped to work well when they flap. Man tried for a while to make a machine that would flap its wings. He generally got killed in the attempt. Finally he decided to try having the wings there, just as the birds do, but not flapping them. He tried to imitate the bird in gliding flight. That was rather foolish, for the birds' wings are made to flap, and when they glide they are using them for a secondary purpose. Man stands on two jointed legs, columns, carefully made and fitted together with some of the most wonderful mechanical features we know of. Why not build buildings, and stand them on similar mechanisms? Simply because legs have only a secondary use in supporting members. They were primarily designed for locomotion.

"Similarly a bird's wings were designed for movement. Then, too, a rotary motion is so much more efficient than a reciprocating motion. The wheel is beyond a doubt a better way to get over ground than the box. Why didn't

Nature use it? A wheel is not such a good thing to climb trees with, and trees are very useful if a solar beetle tiger happens to be in the neighborhood. Evolution did not favor it. Can you imagine a bird with a propeller on its back? The propeller is more efficient than the flapping wing, but Nature couldn't use it—a was a matter of design. Imagine, if you can, a bird with a bare propeller on its back—or somewhere, driven by a bone crankshaft, turned by muscles—muscles arranged like the cylinders of an engine! It just couldn't be done. Nature had to use the flapping wing.

"And man, seeing the bird fly, decided that was the way to fly. He found he couldn't do it, but it took him hundreds of years to find some other way than merely appreciating the bird.

"Do you remember how the little paper gliders of our school days used to soar and bank and turn with perfect control; they never stalled in the air, never stayed in a nose dive, never went into tail spins and were structurally strong enough to be made of thin paper. The standard and only figure that is used in bracing things anywhere is the triangle; it is the root of strength. It can't be deflected as can a square, it is geometrically better. Why not use it! No wonder the pirate's ship would stand the strains he put on it. No wonder it makes an excellent glider. Of course it would.

"He is an ingenious man, but I wish he didn't store quite so much hydrogen in his rocket tubes! It is unbecomingly odd in here, and I can't sacrifice any power to heat it. The rocket ship up there seems to be getting more and more acceleration in the level. He has no dropping steadily to get air to run the generator. He is going fast enough!"

They followed beneath the pirate, faster and faster as the rockets of the ship began to push it forward more and more.

"Dick, why is it he didn't use all his rockets at first instead of gradually increasing the power this way?"

"If you were operating the ship, Morcy, you would understand. Look at the speedometer a moment and see if you can figure it out!"

"Hum—4.5 miles per second—beating right along—but I don't see what that—good Lord! We never will get him at this rate! How do you expect to get him?"

"I am still in the dark on that subject. But Aron, I wonder why it is that he doesn't have to use all his rockets!" said Fuller.

"He is going 4.5 miles a second. When he reaches 5 miles a second he will never come down from his hundred and fifty mile high perch. He will establish an orbit! He has so much centrifugal force already that he has very little weight. We are staying right beneath him, so we don't have much either. Well, there he goes in a last spurt. We are falling behind pretty fast—there we see catching up now—no—we are just holding parallel! He's done it! Look!"

ARON pulled out his watch and let go of it. It floated calmly in the air for a moment, then slowly drifted back toward the rear of the room. "I am using a bit of acceleration—a bit more than enough to maintain our speed. We are up high enough to make the air resistance almost nothing, even at this velocity, but we are held back enough to require some power. I don't know—"

There was a low buzz, repeated twice. Instantly Morcy

turned the dials of the radio receiving set—again the call signal sounded. In a moment a voice came in—low, but distinct. The power seemed fading rapidly.

"—am the Pirate—help if you can. Can you get outside the atmosphere? Exceed orbital speed and fall out? Am in an orbit and can't get out. Fuel reserve gone, stuck, and used all my rockets. No more power. Can not slow down and fall. I am running out of compressed air and the generator for this set is going—will take animation suspending gas—will you be able to reach me before entering night?"

"Quick, Morey—answer that we will."

"We will try, Pirate—think we can make it!"

"O. K.—power about—now—"

The last of his power had failed! The pirate was marooned in space! They had seen his rockets go out, leaving the exhaust tube glowing for a moment before it, too, was dark, and only the sun shining on the silvery plane made it visible.

"We have to hurry if we want to do anything before he reaches night! Radio the San Francisco field that we will be coming in soon, and we need a large electromagnet—one designed to work on about 500 volts D. C., and some good sized storage cells; how many will have to be decided later, depending on the room we will have for them. I will start to slow down the ship now. We are somewhere west of the Hawaiian, I believe, but we ought to be able to do the trick if we use all the power we can."

Morey at once set to work with the radio set to raise San Francisco airport. He was soon in communication with them, and told them that he would be there in about one hour. They promised all the necessary materials; also that they would get ready to receive the pirate when he was finally brought in to them.

"Arrest," asked Fuller, "why don't you just circle around and head back, taking advantage of your speed, instead of killing it in one direction, only to develop more in the other?"

"The circle I would have to turn in would have to have a thousand mile radius, because any smaller circle would mean a centrifugal force that would be fatal to us. I will be able to turn soon, but I must slow down, first."

It was nearer an hour and a quarter later that the machine fell to the great San Francisco landing field, where the mechanics at once set to work bolting a large electro-magnet on the landing sleds on the bottom of the machine. The most serious problem was connecting the terminals electrically without making holes in the hull of the ship. Finally one terminal was grounded, and the radio aerial used as the other. Fuller was left behind on this trip, and a large number of cells were installed in every possible position. In the power room, a hastily arranged motor generator set was arranged, making it possible to run the entire ship from the batteries. Scarcely had these been battered down to prevent sliding under the accelerations necessary, than Arrest and Morey were off. The entire operation had required but fifteen minutes.

"How are you going to catch him, Arrest?"

"I'll overtake him going west. If I want the other way I'd meet him going at over 10 miles a second in relation to his machine. He had the right idea. He told me to fall out to him at greater than orbital speed. I will go just within the earth's atmosphere till I get just under him, hiding myself in the air by means of a down-

ward acceleration on the part of the regular lifting power units. I am going to try to reach eight miles a second. We will be overhauling him at three a second, and the ship will slow down to the right speed in falling out to him. We must reach him before he gets into the shadow of the earth, though, for if he reaches 'night' he will be without heat, and despite the fact that he is in a suspended animation condition, he will die of cold. I think we can reach him, Dick!"

"I hope so. These space cells are all right, aren't they? This acceleration is hard on anything. We will need those! If they don't function when we get out there, we will fall clear off into space! At eight miles a second, we would leave earth forever!"

"But Dick, I don't see how you can get eight miles a second, when helium atoms at room temperature don't move that fast. They won't drive a car that fast will they?"

"Right you are Morey—but for one fact. How fast are helium atoms going at room temperature? Earth goes nineteen miles a second, so they must be going fast enough! They are always trying to go just six or seven miles a second faster than we, so matter how fast we go! It will be willing to drive us at eight miles a second. But we don't want to get too high and feel the generator won't give power enough to slow us down so we can fall, nor power enough to pull us down against centrifugal force!"

The ship was accelerating steadily at the highest value the men aboard could stand safely. The needle of the speedometer was creeping steadily across the dial. They were flying at a height of forty miles that they might have enough air and still not be too greatly hindered by air resistance. The black sky above them was spotted with points of glowing light, the blazing stars of space. But as they flew along, the sensation of weight was lost; they had reached orbital speed, and as the car steadily increased its velocity, there came a strange sensation! The earth loomed gigantic above them! Below them shone the sun! The direction of up and down was changed by the terrific speed, the needle of the speedometer was wavering at 7.8 miles a second. Now it held steady!

"I thought you were going to take it up to eight miles a second, Dick?"

"Air resistance is too great! I'll have to go higher!"

At a height of fifty miles they continued at 8.1 miles a second. It seemed hours before they reached the spot where the pirate's machine should be flying directly above them, and they searched the black sky for some sign of the shining dot of light. With the aid of field glasses they found it, far ahead, and nearly one hundred miles above. Things here in the clear space were far more visible than they would have been if seen through the dull atmosphere.

"Well, here we go! I'm going to fall up the hundred miles or so, till we are right on his path; the work done against gravity will slow us down a little, but I will have to use the power units somewhat. Did you notice what I did to them?"

"Yes, they were painted a dull black. What was the idea?"

"We will have no air, from which to get heat for power out here, so we will have to use sunlight. I am using it now to slow us down as much as possible. That, together with the air resistance and the energy needed

for raising the car one hundred miles, will be enough to slow us down, I think!"

At last the tiny silver dot had grown till it took on the form of the plane it was. They were drawing up to it now, slowly, but steadily. At last the little machine was directly beneath them, and a score hundred yards away. They had long since been forced to run the machines on the storage batteries, and now they applied a little power to the vertical power units. Sluggishly, as they absorbed the sun's heat, the machine was forced lower, nearer to the machine below. At last a scant ten feet separated them.

"All right, Morry."

THERE was a snap, as the temporary switch was closed, and the current surged into the big magnet on the back. At once they felt the ship jump a little under the impulse of the magnet's pull on the smaller machine. In a moment the little plane had drifted up to the new life magnet, touched it and was about to bounce off, when Morry again snapped the switch shut and the two machines were locked firmly together!

"I've got him, Dick. Now slow it down till it falls. Then we can go and wait for it, being a glider, it ought to be quite manageable!"

Now the energy of the power units on the roof of the machine began to slow down the two machines, the magnet grinding slightly as the momentum of the plane was thrust upon it. They watched the speedometer needle drop. The speed was sinking very slowly, for the area of the absorbing fire was not designed to absorb the sun's heat directly, and was very inefficient. The sun was indeed sinking below their horizon; they were just beginning to watch that curious phenomenon of seeing down backward, when they first struck air dense enough to operate the power units noticeably. Quickly the power was applied till the machines sank rapidly to the warmer levels, the only governing factor being the tendency of the glider to break loose from the grip of the magnet.

At fifty miles the generator was started, and the heaters in the car at once became more active. There was no heat in the car below, but that was unavoidable. They would try to bring it down to warm levels quickly.

"Where, I'm glad we reached the air again, Dick. I didn't tell you sooner, for it wouldn't have done any good, but that battery was about gone! We had something like twenty amp-hours left! I am giving the recharge generator all she will take. We seem to have plenty of power now."

"I knew the cells were low, but I had no idea they were as low as that! I noticed that the magnet was weakening, but thought it was due to the added air strain. I am going to put the thing into a nose dive and let the glider go down of itself. I know it would land correctly if it had a chance. I am going to follow it, of course, and since we are over the middle of Siberia I think it would be a good idea to start back."

The trip back was necessarily in the lower levels of the atmosphere, that the glider might be kept reasonably warm. At a height of but two miles, in the turbulent atmosphere, the glider was brought slowly home. It took them nearly twenty hours to go the short distance of twelve thousand miles to San Francisco, the two men taking turns at the controls. The air resistance of the glider forced them to go slowly, they could not average

much better than six hundred an hour despite the fact that the speed of either machine alone was over twelve hundred miles an hour.

At last the great dycroscopers of San Francisco were showing on their horizons, and thousands of private planes started out to meet them. Frantically Arcot warned them away, lest the air blast from their props tear the glider from the magnet. At last, however, the Air Guard was able to force them to a safe distance and clear a lane through one of the lower levels of the city traffic. The great field of the Transcontinental lines was packed with excited men and women, waiting to catch a glimpse of two of the greatest things the country had heard of in the century—Arcot's marvelous motion machine and the Air Plane!

The landing was made safely in the shade of Air Guardsmen. There was a small hospital plane standing beside it in a moment, and as Arcot's ship released it, and then hung motionless, soundless above it, the people watched it in wonder and excitement. They wanted to see Arcot perform; they clamored to see the wonderful powers of this ship in operation. Air Guardsmen who had witnessed the flying game of tag between these two super air-machines had told of it through the press and over the radio.

"Come on, Morry, let's give them a real show, then go home and sleep!"

"All right, Bill. The invisibility act ought to give them a thrill!"

There was a sharp click as Morry turned on a switch—then from the crowd below came a mighty roar of amazement! The ship was gone! Gone completely in an instant! They turned to each other in astonished inquiry, and then came another cry of astonishment as it suddenly appeared, hanging in the air a thousand feet above the point of its disappearance! Then it began a series of loops, turns, twists and maneuvers utterly impossible to any other machine. It hung motionless in the air for an instant, then shot up toward the hot, mid-afternoon sun with a speed that left the watchers gasping with astonishment—and continued on its way to New York.

Two weeks later Arcot had a visitor from the West Coast—a handsome young man of about twenty-eight. Morry was with him at the time. The young visitor looked rather pale, but his six-foot-three made even Morry look to his heels!

"Well, I heard you were of fairly good size, Wade, and it is no wonder we had such a whole of a chase catching you!" said Arcot, smiling at him. "Just think, even old earth couldn't throw you down! We had to go out and help bring you in! But, speaking seriously, I hope you have brought your things with you, because if you are willing I think the Transcontinental can afford to let me have a new Lab worker, Dr. Marsh says you will be a great help to me now! After looking over your different pieces of apparatus, both at the Rocky Mountain Park, so you called it, and in the plane, I am of the opinion that we had better keep all the good wads in the family, so to speak. That was a neat piece of work on the storage of atomic oxygen! Is it all right for you to get the old head to work so soon?"

"Dr. Marsh seemed to think so, Dr. Arcot, and I am not in the habit of forcing opportunity to bridle-his knuckles! I am with you!" But if the idea for the Atomic Hydrogen storage comes through—"

The Non-Gravitational Vortex

By A. Hyatt Verrill

(Continued from page 221)

of countless sea-fowl, and capable of supporting the lives of such creatures as ourselves indefinitely. But we were not deemed to remain for long marooned upon the Frigates, as they were called. A week after we had loaded, a Portuguese whaling schooner passed within sight; she saw our signals, tacked in close to shore, and an hour later we were all safe aboard and bound for Fayal, where we arrived without other adventures.

Professor Hamilton and Sir Esme are still on friendly terms, but each still feels that the other is a bit off, though they never mention nor allude to the matter. All references to their strange experiences are tabooed, but on the subject of wild goose preservation they are entirely in accord. And as neither remembers anything whatsoever in regard to that strange, mysterious force we called Ezerdim, and, as all of its discoverer's records, instruments, data and other material were lost with the *Loch Leven*, the world has never learned the truth. Sir Esme still believes his yacht was destroyed by a terrific atmospheric disturbance—a local cyclone or tornado—and Professor Hamilton is convinced that the same whirlwind wrecked the *Santa Jara*. And never, since the first day when we had taken refuge on the desert, have I attempted to disabuse their minds of their hallucinations nor have I tried to recall the past to them.

And sometimes, when I sit with my two friends, I begin to have doubts myself. I begin to have most dis-

turbing thoughts and to wonder if, by any possibility, it is I who have the hallucinations; if the whole memory of Sir Esme's weird and amazing experiments, the search for the Ezerdim areas, the fate of the yacht, are not all figments of my imagination, the result of the strain of my experiences. Always, when such half-formed doubts assail me, I seek out Hobson, who is now a jolly, prosperous waterman at Great Markowe on the Thames, where he does an excellent business renting punts and canoes. And over glasses of ale in the cozy little pub he keeps beside the river, we talk over old times and the loss of the *Loch Leven*, and I feel vastly relieved and quite reassured when Hobson confirms my memory of what we saw.

"'Loe' love ye?" he exclaims. "Didn' I see her with me own eyes, ayyin' 'round an' 'round like a carousel at a fair, with a hill o' water 'neath her keel, an' aigh onto a cable's length o' thin air twist her an' the sea? Aye, sir, a run sight as ever was, though I ne'er mentions of it to no one, here', as did I, they'd be callin' of me a bloudin' 'oo an' laughin' at it for a cafter's year. But me an' you knows what we seen, sir, an' no denyin' of it. An' 'twas that as made me give up the sea an' tye up with this here. That an' memory o' Cap'n Isister an' me matts gone to Davy Jones in that devil's own giddy-go-round. And how's Sir Esme, sir, an' you professor chap what was Harvey when the *Loch Leven* come to a end, an'?"

The End

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The UNIVERSE WRECKERS

A Serial in Three Parts—Part II

By Edmond Hamilton

Author of "The Other Side of the Moon," "Locked Worlds," etc.

NEPTUNE is nearly three thousand millions of miles from the sun, but that does not necessarily mean that some kind of life is absolutely impossible on it. It may be, of course, if there are intelligent beings on that planet, that they in their turn are convinced that even the earth is uninhabitable because it must be so unendurably hot, being so close to a great heat-giving mass. Creatures may well have evolved on that distant planet to fit with the conditions there, just as human beings, as we know them, are adapted to our particular atmosphere. At any rate, this well-known author gives us a picturesque and striking idea on this subject, and in this second instalment continues his tale of Neptunian life and intelligence at an accelerating pace—almost equal to the increase of rotatory speed these creatures are forcing on our sun. From their point of view, these extraordinary creatures feel justified in threatening all the nearer planets. It seems inevitable, however that our view on earth should differ.

Illustrated by WESSO

WHAT WENT BEFORE

WHEN the scientific world learned, by Marlin's observations on the constantly perceptible increase in the rotatory speed of the sun, matters have taken a serious turn. During a conference at the capital, in which a number of eminent astronomers are present, various theories are propounded as to the cause of this accelerating speed of its axis on the earth. They are convinced that the cause, whatever it may be, is on Neptune, and that several men must be sent to Neptune to learn the cause and perhaps find a cure.

The responsible assignment, a space-flotilla is built and equipped in record time and is sent on its way with three crewmen—Dr. Krollin, Triggly, Harold Markham—and I, who, in its regard, am the helmsman and the ship. When in the orbit of this star, their space-walkers, specially designed to be used by the men outside of the flotilla in extraordinary space in case of an emergency, are also included among the crewmen.

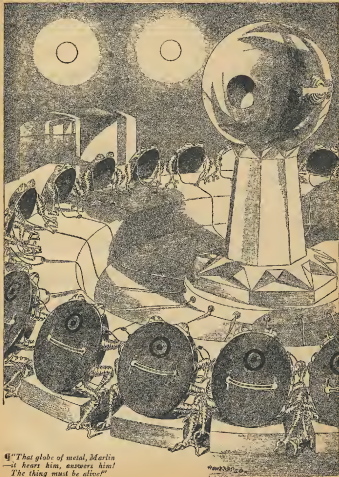
All soon well until the flotilla reaches the asteroid zone, where they stop at midnight sleepers. They awake with only minor discomfort, which they regard as space sickness by means of the space-walkers. A comparatively short time later they come within the atmosphere of Neptune, and find that planet's surface completely covered by a metal sea. They go along and above this sea, until they come to a shallow opening, through which they enter. Some beneath the metal deposit, they see vast conglomerations with queer strange structures. They decide to explore, so Marlin and I, in the space-walkers, venture farther to learn about Neptune and the life-like beings the prove to be the inhabitants of this planet.

In the midst of these investigations, Mar and Marlin look up to see the possibility, attacked by the Neptunians and part of it was another. They continue on their way, following the bay of their beach, but soon detect their way to find the apex of the trouble. Soon they are discovered by some of these life-like neptunians, who, immediately after the foremost gas when a certain cry, they themselves straight forward upon Marlin and I.

CHAPTER VII

The Giant Ray

THE minute that followed was a grotesque whirl of swift action, a desperate reeling struggle between Marlin and me cased in our great space-walkers, and the great disk-bodied Neptunians. Even as they had leaped upon us, we had shot to one side, had brought down upon the foremost of them the great steel bars carried in our pierce-like metal hands, and had sent two of them crumpling to the black paving with a thick green liquid oozing from their shattered bodies. The remainder, though, were upon us before we could strike again, and then as they gripped us I could see the Neptunians who had been working in the adjoining compartment come running toward the combat, to assist their fellows. So that though Marlin and I struck out with desperate fury at the numerous creatures with the great metal jointed arms of our space-walkers, they had in a moment more with their numberless limbs fettered our arms and torn



¶ "That globe of metal, Marlin
—it hears him, answers him!
The thing must be alive!"

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the bars from our grasp, holding us then motionless and helpless.

Thus held, part of the creatures stepped back from us, and then we heard one of them, who bore a single, crimson-circle device upon his metal dress or armor, utter a staccato order to the others. At once four of them drew from their armor the long tubes we had noted there, and trained them upon us. I knew, instinctively, that those tubes held some deadly force like that with which the cylinders had attacked our space-flier in the battle in mid-air. Later I was to learn that the tubes could release a force-ray similar to that used for propulsion by our space-flier and by the cylinders—a force-ray so concentrated into a pencil-like beam that, instead of merely pressing against whatever it struck, it pierced whatever it touched with terrific force, riving it sunder. Knowing the deadliness of the tubes, I looked for instant annihilation.

But it was evident in a moment that it was only as a precaution that the tubes were held upon us. For now while a half-score of the Neptunians held Martin and me firmly by the arms of our space-walkers, the one who had given the order came close to us, clambered with his powerful multiple limbs upon the top of my space-walker, and gazed in through its vision-windows at me. To see those bulging, glassy and insect-like eyes outside the window so close to my own struck me through with a chilling horror greater than anything I had yet felt. I saw that the creature had discerned me inside the space-walker, had assured himself that creatures of his yet different from himself occupied the two cylinders. For in a moment he had observed back down to the ground, and then as he uttered another sharp order, the creatures that held us were dragging us forward, toward the door of the compartment into which we had looked before.

Through that low door they dragged us in our space-walkers, and across the adjoining compartment toward one of the great upright cylinders resting there. In another moment the Neptunians had pulled us inside the door of that cylinder into its dark opening, and I saw the one who had given the orders following, with a half-dozen of his fellows. The others were dispersing to the other cylinders, and in a moment the door of our own slid clanging shut behind us. Then there was a hissing and throbbing of strange machinery in the dark interior of the cylinder about us, and at the same moment the leader of the Neptunians motioned to us to emerge from our space-walkers, having removed their own glowing ball-helmets.

I think that both Martin and I hesitated for a long moment before complying with that command, yet we saw that upon us still were trained the tubes of the four Neptunians who guarded us, so reluctantly we threw open the lower doors of the space-walkers and emerged from them. As we did so, forgetful for the moment of the strange creatures about us, we gazed in amazed interest around us. The huge cylinder's interior, we saw, was divided into a half-dozen compartments by metal floors or ceilings set at intervals of ten or twelve feet from its bottom to its top. A light metal ladder ran up through openings in all of the those floors or divisions, and up that ladder now a few of the many-limbed Neptunians were hurrying toward the upper compartments. We ourselves were standing, with the Neptunian leader of the red circle-designs, in the lower or bottom compartment of the cylinder, his four tube-armed guards and a half-dozen green disk-bodied monsters about us.

That lowest compartment held great gleaming-cased mechanisms, from which came the throbbing that we had already heard, and that was so exactly similar to the throb of our space-flier's generators as to remove all doubt but that these were the similar generators of the cylinder. As our eyes roved about them the Neptunian leader uttered a staccato command, at the same time pointing with one of his seven limbs, up toward the ladder. His meaning was unmistakable, and at once Martin and I stepped toward the ladder and began to climb upward on it, the tubes of the four watchful guards just beneath us as they followed. As we passed up that ladder, through the upper sections of the cylinder's interior, I saw vaguely the things within those sections.

One of them held the disassembled parts of the great clogged mechanisms we had seen them taking down and storing inside the cylinders. Another two or three sections held similar disassembled parts of differing machines that had evidently been taken from another part of the dead vast compartment-city beneath. We passed up through sections that held supplies and strange tank-like affairs, that seemed not unlike the batteries of our own space-flier, and then were climbing up into the topmost section of the cylinder. This was a section whose top and walls were set with so many windows as to make its sides seem quite transparent. And this topmost section, in which a pair of Neptunians already were standing, was quite apparently the control-section.

For at its center rose from its floor a thick metal pillar or standard, upon the top and sides of which were set a battery of dozens of small green studs, and around this were strange seats in which the two waiting Neptunians were now taking their places. As Martin and I climbed into that uppermost section, the guards and the leader of the disk-bodied Neptunians behind us, we gazed wonderingly about, at the central control-standard and at the strange graduated scales with moving dots of light upon them, that were set here and there in the walls and that seemed recording instruments of one kind or another. Then the crimson-marked leader had given utterance to another sharp succession of snapping sounds, a swift command, at the same time motioning us to the side of the circular room, where were similar low, strange seats. In these we seated ourselves, the four Neptunians who watched us taking places on either side of us, and then as the leader took the remaining seat at the control-standard, we saw one of the other two seated there reach forth with strange quick limbs and touch a number of the studs in swift succession.

At once the great throbbing of the generators or mechanisms in the cylinder's lowest section intensified, and as Martin and I gazed quickly outward through the windows about us we saw that now the other cylinders in the compartment were all closed and throbbing like this one. Then, as one of the Neptunians at the control-standard touched another stud, the cylinder in which we were rose swiftly upward and out of the great black-walled compartment, rose up smoothly over the dead compartment-city into the pale light of the Neptunian day, followed at once by the three other cylinders. The dim day about us was already waning, fading, as night crept across this huge world of silence and death, with its ceaseless rotation, but there remained still enough light for us to see far across the mighty maze of compartments that was the deserted and dead city. And now across that city the four cylinders were rushing, racing

over it in horizontal position, the strange sense upon which we and the Neptunians were seated swinging in gimbal-like frameworks as the cylinder swung them from vertical to horizontal.

OVER the huge compartment-city our four cylinders flashed, then slowed and halted, as up from another point in it rose four more cylinders, the four that we had seen land in a different part of it, and whose occupants had discovered and captured us. Then all of the eight great cylinders, our own in the lead, were rising sharply upward, up toward the opening in the vast roof above, through which we had seen them come. As they shot up toward it, Martin and I, glancing down and backward, could see—even as we had seen from our space-flier, the vast extent of the dead and deserted compartment-city, with its mechanisms and huge girders and high black intersecting walls lying now in such dusty stonage and death. Yet it was only for a moment that we glanced back toward it, for now our eight cylinders were flashing up through the round opening in the huge roof, and out over that vast roof, seeming solid metal from above, that covered all of mighty Neptune. And as we flashed over it, now, I found for the first time opportunity to whisper to Martin, beside me.

"They're leaving Neptune!" I whispered. "Where can they be going, Martin? And what has happened to Whitley and Randall?"

He shook his head, answered in the same low tones. "Whitley and Randall have escaped, I hope. They had a small start on their pursuers—they may have eluded them here above Neptune—"

We were abruptly silent as the guards glanced suspiciously toward us with their bulging multiple eyes. And so the great cylinder and those behind shot on, the huge metal roof of Neptune below and the vast vapour-masses of its dense atmosphere stretched about us, I wondered if ever men had found themselves in the position that now was ours. Captured by monstrous diabolical beings of horror unnumbered, flashing with them above the vast roof that shrouded Neptune and its dead, deserted and colossal compartment-city, to a destination of which we could not dream! And as that thought passed, another came, and I remembered the great mission that had brought us out here to the borders of mighty Neptune, our great flight outward to find and put an end to the huge force-ray that was stalking across the solar system and turning the sun ever faster, with every day bringing it nearer to the decision that meant doom for almost all in the universe. What chance was ours to accomplish that mission now, separated and captured as we were, not knowing even from what source the great ray was issuing, from what strange place those diabolical beings had come and to which they were now returning?

I was aroused from my silent despair, though, by a low exclamation from Martin, and looked up to see that the cylinders of which our own was foremost had now halted, hanging midway between metal roof beneath and great vapor-masses above. Then down from above I saw, dropping quickly toward us, three other cylinders similar to the eight, three cylinders at sight of which my heart beat suddenly faster. For it had been three cylinders that had pursued Whitley and Randall in the space-flier! Tensely I watched as the three drove down among our eight, and then one of them had shot suddenly close to

the cylinder in which we were, hanging beside it so that its low door-opening was directly touching the door-opening of our own. There was a clong of metal beneath as the doors of both cylinders slid aside. They fitted so closely against each other that no colder air from without could enter into the warmed interior of the two cylinders. Then from the other, were coming into our own cylinder three Neptunians who climbed swiftly up into the top-section in which we were, while Martin and I watched them in indeliberate suspense.

As they came up into the uppermost section they spoke in their sharp, staccato talk to the Neptunian leader of the crimson-circle insignia, making report to him, it was apparent. But it was not to their stopping speech that Martin and I gave our attention, but to the things they carried in their grip, and which they were showing to the leader. Those things, I saw with a start of horror, were some shattered and crumpled plates of metal, great flat metal plates that I recognized immediately as being of our space-flier's heated sides! And they also held a broken, twisted metal thing that I recognized instantly as one of the space-flier's smaller liquid-oxygen tanks! I needed not to understand the strange speech of the Neptunians in that moment to understand what the three were reporting. For those shattered fragments of the space-flier told the tale with terrible clearness.

"Whitley and Randall!" It was Martin's whisper of horror beside me. "They were caught by those pursuing cylinders—were annihilated by their rays—"

"Whitley and Randall—!" I felt my voice choke then, as I gazed at those low fragments of the space-flier's wreckage, mutely testifying in the end which our friends had met with beneath the shattering rays in their space-flier somewhere in the cold, vast vapor-masses above us.

Whitley—cool and detached and steady, stirred to passion by nothing save some unprecedented physical phenomenon, considering with curious, impersonal eyes each new peril that had confronted us; and Randall—with his sunny hair and eager young courage and unflinching sense of fun; it was as though they had been before me in that moment, when we saw at last what death had overtaken them and our space-flier there in the chill clouds of mighty Neptune. I felt Martin's steady hand on my shoulder and knew that he was awaiting similar depths of despair. For with Whitley and Randall gone, with our space-flier and with ourselves captured and held by these monstrous diabolical Neptunians who yet seemed not of Neptune, our chance to halt the great doom-ray that was radiating toward the sun, our chance even to return to earth with word of the position and nature of that ray's source, was gone also!

Through the despair that had smitten upon me I was aware, in a moment, that the throbbing of the cylinder's great generators had waxed again in intensity. Already the three Neptunians, who had reported the destruction of the space-flier, had returned to their own cylinder, which had separated from ours, and now the whole eleven cylinders, our own in the lead, were racing forward once more, were shooting forward between the great vapour-masses above and the vast metal roof below. At immense and mounting speed they shot forward, a dull roar of whistling air coming to us from without and in a moment the pale, dim light about us had begun to change to dusk, to darkness, as we shot on. For the eleven cylinders were racing around the surface of Nep-

tance toward the side of it away from the sun at the moment, and as they entered the shade of that side they were plunging through the eternal night. But as the cylinders shot on they seemed to need no light or star to guide them through the deep darkness, though all that was visible was an occasional glinting of the great metal roof below.

On we shot through that deep darkness and there rose in me a sudden thought that roused me a little from the despair that held Martin and me. Could it be that upon that other side there still remained a remnant of their race? A remnant of the race, that once had built the mighty compartment-city that covered all Neptune and the vast roof that sheltered it, but that now occupied but a small part of the huge city? Was it from Neptune's other side, then, that the giant force-ray had stabbed toward the sun? Yet how could that be so, how could that great ray be shot out from any point of Neptune unopposed as it was, when each twenty hours the great planet turned on its axis, when for half of that twenty hours whatever point that was the ray's source would be turned away from the sun instead of toward it?

WITH some interest Martin and I gazed ahead into the darkness through which our cylinders were rushing, while at the control-standards the leader and the other two Neptunians manipulated the force-rays that were propelling onward the cylinder in which we were. At last, after some minutes of this rushing flight of immense velocity, the cylinders seemed to slow down, to pause. Looking out I could discern the surface of the gigantic metal roof below us, just showing itself to us by a little glint of light here and there from it, and in that moment Martin and I waited in suspense for the cylinders to sink down toward and through it, to whatever place upon Neptune's other side it was that held the remainder of their strange race, since by then, we knew, we were at that side of Neptune almost exactly opposite the sun. Only a moment the cylinders slowed and passed, and then were leaping through the air again at mounting speed. But instead of flashing downward toward the great roof, they were flashing upward!

Upward they were shooting, up through the dense air and straight into the great vapor-masses that loomed above us! Through those great clouds they were racing then, diving upward through them as through a darker darkness, and then suddenly had shot up and out from them, up and out into the clear and thinner air of Neptune's atmosphere's outermost limits. Behind our cylinders dimly lay the huge, vapor-veiled planet, shrouding out by its vast bulk all light of the sun's distant little disk of fire, or of the greater planets. But before us there stretched once more the black vault of space, unfolding itself to our eyes for the first time since we had remained down through those shrouding vapors to Neptune's surface.

Brightest in that black void there shone, before and somewhat above us, Triton, the moon of Neptune. It was almost white in color, tinged with the pale green of great Neptune, about which it moved, and seeming of the same size to our eyes as earth's own moon. Beyond and all about it, though, there flamed the great stars, seeming the same to our eyes here at the solar system's outermost limits as they had seemed to us when far within it, at earth. The great field of stars and star-glusters that was Sagittarius, straight ahead and upward,

the irregular parallelogram of Capricorn's stars, to the left, the dazzling criterion heart and jeweled mawing claws of Scorpio, to the right—all seemed to our eyes as they had seemed when we had started—how long ago it seemed!—out from earth toward great Neptune, that lay now behind us. Yet now, with Neptune behind us, our eleven cylinders were flashing forward with greater and greater speed, were flashing out apparently from the solar system's last outpost into the vast void of interstellar space!

"They're going on—going out from Neptune into outer space!" I exclaimed to Martin, as we gazed ahead, transfixed.

But suddenly he shook his head, pointing ahead and upward, for now the cylinders were flashing upward as well as forward. "It's Triton they're heading toward!" he said. "Triton—Neptune's single moon!"

"Triton!" I exclaimed, thunderstruck with amazement. "Then—then—it must be on Triton that the remaining Neptunians now are!"

Triton! For it was up toward it, up toward the white, green-tinged moon of Neptune that shone dimly in the black vault above and ahead of us, that the eleven cylinders, our own in the lead, were heading! And as they shot out of the last limits of the atmosphere of Neptune, as they flashed forward at swiftly mounting speed still toward the moon, I could but stare at it in amazement. Triton! It was from it, then, that there had come these strange disk-headed Neptunians who had captured us, who had annihilated our space-flier and our friends. It was on Triton, then, that there must remain whatever Neptunians still were left of those who had built the vast compartment-city that covered all the surface of Neptune itself, who had sheltered it with that gigantic floating roof that enclosed all the mighty planet. Yet why had they deserted their vast compartment-city, their great world of Neptune? Why had they left that world for the single moon of Neptune, so much smaller in size? And the giant force-ray that was shooting on one space to the sun, turning it over faster, was it from Neptune then or Triton that that infernal ray was radiating?

It seemed to me that these questions were spinning in my head in a kaleidoscope whirl of enigmas, as our throbbing cylinder and the sea behind it shot on and upward at a great slant toward the dim-gleaming sphere of Triton. Martin, beside me, was staring ahead obviously as much mystified as I was, while the four Neptunians ranged on either side of us kept their ceaseless watch upon us. The other three sat still at the control-standards, directing the cylinder on its rush out from Neptune toward us. And now, that moon grew larger ahead of us and above us, a strangely-gleaming sphere that seemed still very small, in comparison with the huge pale green disk of mighty Neptune that loomed behind us.

I knew, though, that Triton was of the same approximate size as earth's own moon, and revolved around the great planet at the same approximate distance as earth's own moon, roughly a quarter of a million miles. As we had noted from our space-flier in flashing out toward Neptune its moon was now behind the great planet, that is on the other side of it from the sun, but due to the sharp inclination of the plane of Triton's orbit around Neptune, it was so much higher than its great planet in space, as to make it possible to see the single moon, even from Neptune's sunward side. And now as our eleven

cylinders shot toward it, it was spreading out across the black vault of the heavens before and above us, until at last we were within a few thousand miles of it and the speed of the cylinder was perceptibly decreasing beneath the controls of the three at the central standard.

Smoothly the cylinder, and the ten behind it, slowed, until they were racing forward at a comparatively low velocity. Triton's dull-glimmering sphere filled the heavens before us. Behind and a little below the great green disk of Neptune, belted with the vast cloud-masses of its immense atmosphere, loomed almost as great as ever to our eyes. And far beyond it there burned the sun's bright little disk, just above the huge sphere of Neptune, and visible to us through the thinner vapors of Neptune's uppermost atmosphere. We turned back toward the outer world of Triton. As the cylinders rushed on toward it, all the suspense of expectation and mystery that had been ours since our first arrival at the strange dead world of Neptune gripped us now with renewed power. And as Marlin and I stared ahead we were aware that the cylinders were dropping, swinging about our pivoted seats and dropping toward the surface of Triton that seemed now to gleam beneath us.

Toward it we smoothly shot, and as Marlin and I gazed intently down we saw that there were below none of the great cloud-masses that wreathed the surface of mighty Neptune. Instead was only a smooth and strangely gleaming surface that we could but vaguely glimpse, and the sight of which made my heart pound in sudden anticipation. Could the thing be—could it be that here upon Triton as upon Neptune—? But my wondering speculations were cut abruptly short by reality as we shot lower toward the surface of Triton, as that surface came clearly at last to the eyes of Marlin and myself, bringing involuntary exclamations of amazement from us. For that surface was metal! Triton was shielded on all sides by a giant metal roof similar to that which enclosed great Neptune itself!

DOWN toward that mighty roof our eleven cylinders were rushing. When they seemed just above it, they halted their drop and raced along above it, around Triton's vastly curving surface. As they did so, Marlin and I, gazing downward, saw that the vast roof that shielded Triton appeared to be, from above, of the same dark metal as that which protected Neptune, and that it extended away without break or seam as far as we could see over the big moon's surface. And as our cylinders flashed above it, around the world's surface, we were aware that Triton had an atmosphere even as had its great parent world, since from outside was coming the dull roar of air against the speeding cylinder. It was a fact startling enough, but at that moment it was driven from our minds by a thing more startling still.

For as we flashed thus around Triton's outward side, Marlin suddenly uttered a hoarse exclamation, pointed ahead and to the left. I gazed in that direction instantly and for a moment saw nothing unusual, but then as the cylinders flashed on I saw that in that direction was what seemed a great round opening in the smooth, dark metal, a Titanic circular opening that must be miles across. Up out of that opening was rising what seemed at first glance a vast cylinder of pale light that sprang straight up and outward from the gigantic opening, and that was only visible for a short distance above that opening, fading swiftly into invisibility as it shot out into the gulf of

space from Triton. Instinctively my eyes followed the fading length of that mighty beam outward, and then as they did so I felt sudden, awed understanding descending upon me and stared with Marlin toward the giant pit and its great ray in stunned silence. For that giant ray was pointing straight into the great gulf of space, toward the tiny, fiery disk of the distant sun!

"The giant force-ray!" Marlin whispered. "The great force-ray that's turning the sun ever faster—and that we came out here to find!"

"And pointing straight toward the sun?" I exclaimed. "Pointing through Neptune's upper atmosphere toward the sun?"

For we could see now that, the giant ray, visible only there at its source, must indeed be clearing through the upper limits of great Neptune's atmosphere as it reached across the great gulf toward the sun. For since Triton was on the other side of Neptune from the sun, was on its outward side, the great green sphere of Neptune lay almost between the sun and Triton, the big moon being high enough above the great planet, though, due to the inclination of its orbital plane, to make the sun visible to it through the upper reaches of Neptune's vast atmosphere. Through that atmosphere, therefore, we knew, the giant force-ray must be driving on its path across the solar system toward the sun, hurtling across the gulf to strike against that spinning sun's edge with terrific pressure and to spin it ever faster toward that day of division and doom that was marching relentlessly upon it!

But as our cylinders now swept nearer toward the giant force-ray and the pit from which it stabbed up and outward, Marlin and I were soaring obliquely down into that vast pit. Seen from the side as we saw it, the tremendous opening seemed only like a mighty well of metal, from which the colossal pale force-ray, almost as great in diameter as the huge pit, stabbed. We could see, however, that set near the great pit's top at regular intervals around its curving wall were what seemed metal cube-like rooms, which were set on the pit's smooth curving wall. They were a score in number, those out-jutting metal cubes, and from slots in their walls came light from within, and glimpses of stud-covered walls and Neptunians moving about them. We knew, without doubt, that those twenty cubes held within them the unbelievably complex controls of this mighty force-ray that was destroying the solar system!

But now our cylinder and the ten that drove close behind it were passing the vast pit, the huge force-ray. I noted that they took extreme care to pass the mighty ray at a respectable distance, and knew, too, the reason for it, knew that any luckless cylinder that blundered into that colossal out-stabbing ray would be driven instantly at terrific speed and force out through the solar system and into the sun that the ray was striking! So that it did not surprise us that the cylinders veered far to the side of the huge ray, picking up speed once more when they had passed it, and racing on around Triton's metal-shielded surface and through the odd, dense atmosphere outside it. But as the cylinders drove on the eyes of Marlin and myself now were turned backward, back toward that gigantic pale ray of awful force that shot ceaselessly up and out from that vast pit in Triton's metal side.

"We've found it—the great ray we came out here to find—the source of that ray," I exclaimed to Marlin, "but we've found it too late! Whiterly and Randall and the space-flier annihilated—so captured—"

He bent toward me. "Keep your courage up, Hunt," he said. "We may have a chance yet to get free—to get away from this world of Triton before they take us down inside it."

"But what—?" I began, when with a gesture he cut me short. "No more now, Hunt—the guards are watching. But be ready to act if a chance shows itself, for once down in Triton, we'll probably have no chance."

I saw that the four disk-bodied Neptunians who sat about us and guarded us were indeed watching us closely now with their strange bulging eyes, so gave over for the moment our whispered conversation, though with a slight gleam of hope. Glancing back again toward the great force-ray that was almost invisible behind us as the eleven cylinders raced us around Triton's metal surface, I was aware that Martin was staring back toward it also, intently, shading his head a little, as though puzzled by something concerning that giant beam of force. In a moment he turned his attention ahead. Our cylinders now were fading around Triton from its sunward side to its dark side, and so we rushed on Martin and I could see that to all appearances Triton was not rotating, or at least not about a low rate of speed. Then as we entered into the deeper shadow of the dark side, the sun's little disk vanishing behind us as we shot around Triton's curving surface into the shadow, Martin uttered a low exclamation once more, and as I turned to look in the same direction I saw that far ahead there was stabbing out and upward into the black void of outer space a second giant force-ray like that one we had already seen shooting toward the sun!

Stupefied, I gazed toward it. For the first giant force-ray, amazing as it was, had yet been exposed by us, more or less, since we had known from the first that such a colossal force-beam was stabbing from the region of Neptune toward the sun. But this second mighty force-ray, which seemed exactly the same in size and appearance and which rose from a giant pit or well in the vast metal roof even as did the first, was not directed toward the sun. For it was on the other side of Triton from the first ray, was exactly half around Triton from the first and was going out into space in an exactly opposite direction! Thus while the first colossal force-ray, springing out from Triton's sunward side, shot straight toward the sun, this second huge force-ray, on Triton's dark or outer side, was radiating straight out into the vast void of interstellar space, was radiating straight out, in all appearances, toward the unfathomably distant stars of Sagittarius that burned in that mighty void!

What could be the meaning of this other colossal force-ray, of equal size and power, going out into the vast void outside the solar system? The first great ray that was shooting toward the sun and turning the sun over faster—its purpose was at least comprehensible, but what purpose could there be in sending an opposite and equal ray out into the mighty void from Triton's other side? That was the question that whirled in my agitated brain in that moment as the eleven cylinders shot on toward that second great ray, over Triton's metal surface. Martin, though, on seeing that second great ray, seemed to be less puzzled than before. It seemed to have solved for him some problem which the sight of the first huge ray had suggested. To me it was utterly incomprehensible, and perplexed and awed I watched that huge pale ray and the vast pit from which it sprang as we raced toward them. I saw that on that pit's curving walls

there jutted forth a score of cube-like projections or control-rocks similar to those in the pit of the first ray. Then I forgot pit and rays alike as the cylinder in which we were and all those behind it slowed suddenly in mid-air and then dipped sharply downward.

DOWN and down they shot, toward the vast gleaming metal roof of great Triton; down, until we saw that just beneath us there was outlined in that roof a great circle, slightly sunken. Toward this the cylinders dropped, and then as they came to a pause just above it I saw that set beside that circle in the roof was a transparent section beneath which was a small cage-like room, brightly lit. In this were a half-dozen Neptunians, and as they saw the eleven cylinders dropping and passing above the circle in the roof they turned swiftly, passed what seemed a series of knobs in their own room, and at once the great sunken circle beneath us was sliding along beneath the roof to one side, sliding smoothly away and leaving thus beneath us a great circular opening in the roof.

Instantly up from that opening around our cylinders was rushing a torrent of air, a torrent of uprushing air that I understood well was caused by the warmer air beneath the roof rushing up into the colder outside atmosphere. But now down through that opening and through the air-currents the cylinders were swiftly dropping, and we could see far below in dim light a great compartment-city like the one we had found upon Neptune! In a moment more we would be below the roof, the opening closed above us, imprisoned hopelessly in Triton to meet whatever fate our captors decreed. Already two of our four guards, and two of the Neptunians at the control-standard, had left the cylinder's uppermost section and had clambered down the ladder to the lowest section in preparation for emerging. There was left with us in the uppermost section of the cylinder only two guards and the Neptunian leader of the cross-section triangles at the control standard. And as I saw that, I was leaning quietly toward Martin.

"Now's our chance, Martin!" I whispered tensely. "If we could overpower those three Neptunians and the rest beneath afterward we might yet get back to earth!"

He glanced calmly around, then nodded. "We'll take it!" he whispered. "Once beneath this roof of Triton, there'll be no chance."

"Go for the guard beside you, then, when I cough as signal," I told him. "If we can dispose of them and the leader there we can hold the rest below for a time."

He met my eyes with his own, then turned and as though merely shifting a little in his seat moved nearer toward the guard on his side. I had already done the same toward the disk-bodied monster beside myself, both guards having slightly relaxed their first watchfulness. I glanced out, saw that even at that moment our cylinder was sinking with the others toward the great opening in the roof and knew that no moment was to be lost. So, with heart beating rapidly now, even as our cylinder prepared to sink down through the opening with the rest, I coughed slightly. In the next moment I had flung myself with a single motion upon the Neptunian guard beside me and had seen Martin in the same instant throwing himself on the monster at his own side!

The moment following was of such swift action as to defy the memory. In my leap upon the Neptunian beside me it had been my first object to knock his tube from

his grasp before he could loose its rays upon me, and so swift and sudden was my attack that I did so, so did Martin with the other guard. With the same motion, even as the guard's seven great limbs reached toward me, I had grasped his long disk-body and then with a superhuman effort had raised it in my arms and had cast him from me, down through the opening in the section's floor to crumple against the floor of one of the sections below! I whirled, saw that the other guard had gripped Martin and was bearing him down, and then even as there came from beneath and from the Neptunian leader at the control-standard cries of alarm, I had gripped that other guard likewise and hurled him across the cylinder to strike with stunning force against its wall! Then Martin and I were whirling toward the Neptunian leader at the control-standard, but in the moment that we turned toward him we stopped short. For that Neptunian had leaped aside from the controls of the cylinder and had swiftly drawn his own ray-tube!

CHAPTER VIII

Prisoned on Triton

NOTHING, I know now, of our own doing could ever have saved us from the death that in that moment loomed dark and close above us. For, as the Neptunian leader raised the tube toward us, I knew that before ever a leap could take us across the cylinder to him, the pencil-like rays of force from his tube would be tearing through us. For that split-second, therefore, escape seemed impossible, and then indeed we could fully realize the situation there came an interruption. The currents of warmer air from the opening just beneath, down through which the cylinder had been dropping with the others, were sweeping still upward with great force around the cylinder. Only the Neptunian's grasp on the controls had kept the cylinder loading down through those currents, and now, as he leaped away from the controls for the moment and drew his tube, those currents immediately seized upon the unguided cylinder and in the next moment had whirled it over and sidewise with immense speed and power! And as it whirled thus over, Martin and myself and the Neptunian before us were thrown instantly and indiscriminately to the cylinder's side!

For a moment we reeled helplessly about the whirling cylinder's interior, about the utmost section, and in that moment all thought of battle had left us. Then, as I felt Martin and the Neptunian leader and the stunned guard rolling with me indiscriminately, I was aware, too, of cries from the cylinder's other sections and of Neptunians drawing themselves up to the utmost section on the ladder. Alas! in a moment more the cylinder stopped, hung poised and upright as before, and then as Martin and I scrambled to our feet we saw that a trio of the Neptunians beneath had made their way up to the utmost section, despite the cylinder's whirling, by means of their multiple limbs, and that while one now held the controls the other two had their tubes trained over more full upon us!

Our wild attempt at escape had failed, it was evident, for now, as the Neptunian leader of the crimson circle rose, he was addressing to the others a sharp, snapping order, and at the same time motioning Martin and me temporarily to the seats we had formerly occupied. We

took them with no further resistance, for we knew that our desperate outburst had put the Neptunians upon their guard and that the slightest suspicious motion on our part might well mean instant death. And as we seated ourselves once more with the guards on either side, one from beneath replacing the one I had killed, the despair that formerly had filled us seemed immeasurably intensified. For now the cylinder was sinking down after the others, through the great opening in Triton's roof, and even as Martin and I looked outward we saw the great opening in that roof closing again above us with a clang that to our ears was like the clang of doom.

Above our sinking cylinders now there stretched the great roof, and, even as Neptune's enclosing roof, this one was almost entirely transparent from below, though opaque from above. And here as on Neptune we could see no supporting pillars whatever for this vast spherical roof that enclosed all Triton. This world seemed, indeed, but a smaller replica of mighty Neptune. For, as our cylinders sank down through the shadows of its darker side and then leveled out and began to rise back toward its curving surface toward the sunward side once more, we saw that all of Triton's surface was covered, even like Neptune, with a great compartment-city whose intersecting black walls stretched in their vast checkerboard arrangement over all the great moon's surface. But as our cylinders shot over these, over the darkened portion of the surface of Triton and toward the sunward side, we saw that the compartment-city beneath was different, in some features, from that of Neptune.

For one thing, there were moving to and fro above it a number of great cylinders like that in which we were, and in the compartments of the darkened side moved, too, a few Neptunians here and there. And the great globes of metal that dotted this compartment-city of Triton, even as that of Neptune, were here glowing with radiant light; glowing, I knew, with radiant heat. For this was the secret of the Neptunians' residences on Triton, this heat that glowed from the numberless great globes set in compartments here and there. These great glowing globes kept the air beneath Triton's great roof warm and comfortable, the great roof itself preventing that warmer air from escaping into the moon's colder outer atmosphere. As we shot on over the darkened side of Triton, the side turned away from the sun, I could not but think that the contents of the Neptunian race must be few indeed, so few of them moved in the shadowy compartments beneath.

At last as Martin and I gazed ahead, we could make out a brighter crescent of light at the edge of the strange moon-world, and as we shot on we saw that we were approaching the edge of the sunward or sunlit side. A moment more and we could see it clearly and as we did so Martin and I gaped at utter amazement. For that part of the great compartment-city that lay on Triton's sunward side, in the pale sunlight, was swarming with incalculable millions upon tens of millions of Neptunians! Crossing, meeting, pressing together, they were pouring to and fro through the compartments in the pale light of day, busy with the mechanisms that scarce had room in those compartments, so great were their crowds! And over this sunward side hundreds upon hundreds of cylinders swarmed, rushing to and fro!

"Neptunians! Neptunians in countless millions here on the sunward side of Triton! But why then are there so few upon the dark side?"

Marlin shook his head at my exclamation. "I can't guess," he said. "And I never dreamed that——"

Before he could finish the sentence there came an amazing interruption from beneath. As we gazed downward from our speeding cylinder we saw a great band of intensely brilliant white light spring suddenly into being at the very line that marked where dark side and sunlit side of Triton met. A mile in width, that great brilliant band of light seemed to extend clear from Triton's north pole to its south, as far north and south of us as our eyes could reach. And then, even as we stared, astounded at it, that brilliant and immense band of light was moving around Triton's surface over the dark side! Swiftly it moved, like a great wave of brilliant light sweeping around Triton's surface, and in a moment had disappeared from view for around the horizon from us on the dark side!

And as that dazzling light-band moved around the big moon-world's dark side, around the almost empty compartment-city that covered that dark side, we saw crowding into that compartment-city of the dark side, as though from its walls themselves, millions on millions of disk-bodied Neptunians that matched in number the vast swarms on the sunlit side! And as we gazed down in utter amazement we saw from whence they came. There were in the dark compartment-city's extent many compartments like those we had seen upon Neptune, with nothing in them save shelving, which formed in their walls myriads of shelved openings a few feet in height and some four feet in width, one above the other. And in these narrow, flat shelf-openings countless Neptunians had been sleeping! Their disk-bodies, with the flexible legs drawn up, fitted snugly into those flat, strange openings in the walls, and vast hordes of them, countless millions of them, had been sleeping in the shelf-compartments on Triton's dark side!

As that band of brilliant light swept swiftly across the dark side, though, they had awakened, were pouring forth in all their hordes into and through the compartments, all streaming toward the sunward side, while the more remote of them were heading toward the same side in flashing cylinders above. Then, as we gazed toward that sunward side, we saw the brilliant band of light reappearing there, moving swiftly still around Triton's surface, through the pale dim light of its sunward side, having in those moments moved completely around Triton! It moved on until in a moment more it had stopped where first it had formed, at the junction of the dark and sunward sides. There it hung for a moment, dazzling, and then had suddenly snapped out of being. And now we saw that all the crowding millions of Neptunians that had been busy upon the sunlit side were streaming through the compartments toward the dark side!

"The Neptunians' day and night!" Marlin exclaimed, as we gazed downward. "Triton must keep one face always toward the sun and one dark, so these Neptunians spend their day on the sunlit side and sleep their night on the dark side!"

"And that great band of light that traveled around Triton was their signal, then?" I asked.

It was plain now that that was the astounding truth.

These countless millions of Neptunians, coming here to Triton for some reason, had been accustomed upon their own great turning planet to a day and night of ten hours each, much like those of earth. Triton, though, as we

had already guessed, kept the same face always toward the sun, it was evident, turning at just such a rate of rotation as compensated for its revolutions around Neptune and its slower movements with Neptune around the sun. Thus, with one face always toward the sun and the other always in darkness, the Neptunians had been forced to establish arbitrary day and night periods, dividing their millions into two great bodies, apparently. While half of them worked on the sunlit side for ten hours, in their day, the other half were sleeping upon the dark side. Then, when the ten hours ended, the great band of light went around Triton as a signal, and the two bodies of them changed places, the millions who had worked upon the sunward side taking their places for an equal period of sleep on the dark side, while those who had slept on the dark side streamed to the sunlit side for ten hours!

Even as we watched from our speeding cylinder we saw that great change taking place, millions upon millions of the Neptunians streaming from one side to the other in great throngs through the compartment-city, while, from farther around Triton's two sides, rushed countless cylinders, in which hords of others were changing sides. Within a few minutes, it seemed, that change had taken place, and beneath us on Triton's sunward side there thronged in the pale light of its day the vast hordes that so lately had been sleeping, while on the dark side the other masses of the Neptunians had disappeared into the countless shell-like openings of the sleep-compartments, to lie in sleep for another ten hours. In marvelling wonder Marlin and I stared, and then woke suddenly to a realization of our own position.

Beneath us there lay the very edge or dividing line between the dark and sunlit sides, a belt of twilight dusk that was very narrow. Squarely across that belt, we saw, there lay beneath us a great compartment that was largest by far of all that we had yet seen, and that was unique among them in that, instead of being rectangular, it was circular in shape. Down, over and past that mighty circular compartment our cylinders were speeding, and we could but vaguely see some circular object inside it, when we were past it, were speeding low over the thronged and busy compartments of the sunward side. Rapidly the speed of the cylinder decreased, and then they had paused in mid-air, were beginning to descend. And in a moment more they had come smoothly to rest in a great rectangular compartment which seemed reserved as a landing-place, since on it there rested scores of other cylinders, others constantly arriving or departing. Later we were to learn that these landing-compartments were scattered in large number over Triton's surface, on the sunlit and dark sides both.

For the present moment, though, Marlin and I were gazing only at our immediate surroundings. As we landed the guards on either side of us gripped us tightly, the others keeping their tubes pointed toward us, and then, as the throbbing of the cylinder's generators ceased, the Neptunian leader of the crimson circle insignia entered a staccato order. At once our guards were thrusting us toward the ladder that led downward, and, holding us above and beneath, were descending that ladder with us into the cylinder's lowest compartment. There the Neptunian leader followed us in a moment, and as the cylinder's door was slid open a flood of warm, heavy air and a babel of sound from about us rolled inside. Before emerging, though, the Neptunians performed an action that for the moment puzzled me completely.

This was to take from the cabinets in the cylinder's side a number of small metal objects that seemed to be disks of gray metal a few inches across with flexible metal straps attached to them. These the Neptunians attached to the bottom or ends of their strand, direct limbs, as though little round sandals of metal. Then at the order of their leader they took other disks and attached them to the feet of Marlin and myself, one to each foot, leading them to our soles by passing the flexible straps up around our ankles. The thing was as puzzling to Marlin as to myself, for the moment, we could not understand its object until, a moment later, the Neptunians began to pass out of the cylinder to the paving of the compartment outside. For as they did so I had reached toward one of the unused disks to examine it and had uttered an exclamation to find that, though so small in size and thickness, it was of many pounds weight! Yet as Marlin and I, in answer to the leader's order and gesture, passed out of the cylinder to the landing-compartment's floor, we could not feel at all the weight of dozens of pounds which had been fastened to our feet!

Alas, though, light came to my perplexed mind "Trium!" I exclaimed. "It's of about the same size as earth's moon and hasn't much more gravitational power. And these Neptunians, used to the far greater gravitational power of Neptune, have to use these weights to add to their weight here on Triton to make it possible for them to move as always!"

Marlin's eyes widened, and then he nodded. "It must be so," he said. "I wondered when I saw them from above how these masses of Neptune could move so freely as its smaller moon."

It was, indeed, a simple, yet ingenious device which the Neptunians had adopted. Assuredly as they had been to the great gravitational power of Neptune, seven-tenths more that of earth, their quest, strange bodies owing their form to that great gravitational power, their masses would have sent them through the air of Triton in immense and uncontrollable leaps at each step, so much smaller was the moon-world's gravitational power. So they had devised these small disks which fitted to the end of their strange limbs, and which, though so small and thin, yet had great weight, no doubt because the atoms of their substance had been compressed closely together for the purpose. The Neptunians had used disks of some thickness for themselves, and had used thinner ones for Marlin and myself, their smaller weight just sufficing to counteract the difference in gravitational power between earth and Triton. And now, as we stepped out into the landing-compartment with our guards, it seemed as though we were walking with lead-weighted shoes at the ocean's bottom.

The landing-compartment about us held scores of nesting cylinders like our own, and even as we looked about we saw throngs of Neptunians hastening forward and returning from our own and the other ten that had just landed, the disassembly of mechanisms which they had brought from Neptune. The leader, however, mentioned to our guards to follow with us, and set off quickly across the landing-compartment toward one of its doors. Following him, our four tube-armed guards watched now about us, we saw him pass through the low, broad door before us, and though his strange disk-body passed easily through that door, Marlin and I were forced to stoop low to get through it. Then, our guards never

relaxing their caution with our us, we were moving on through the next compartment, and the next, and the next, or through compartment after compartment, all thronging with Neptunians, moving across the great compartment-city toward the twilight band that divided Triton's dark and sunlit sides.

And as Marlin and I moved with our guards and their leader thus through the pale daylight of Triton, through the compartments crowded with masses upon masses of Neptunians, we forgot almost the uncertain fate that hung over us, in the interest and wonder of what we saw. For though we had explored the greater compartment-city that covered all the surface of mighty Neptune, had seen its marvels also, it had been a city dead, a city of lifeless and unused mechanisms whose purposes we had not been able to guess. But here on Triton, in the compartments that covered its surface, we saw a Neptunian city bursting with crowding life, saw it as the giant city of Neptune itself must once have been, before some unguessed purpose of the Neptunians had brought them here as Triton. And, seeing it thus, we were able to comprehend many things that had puzzled us in our venture through the city on Neptune's lifeless surface.

WE passed through compartments in which throngs of Neptunians moved about great rows of loom-like, pear-shaped mechanisms such as we had seen on Neptune, great water-making mechanisms that were beating here with a slow, rhythmic sound of power, and from which there pulsed into the great connecting pipes a constant gush of water. That water, we knew, was made synthetically in the mechanisms by the combination of hydrogen and oxygen atoms, but whether those atoms were derived, as on Neptune, from the break-down of Neptune's great vapor-masses, or whether they were formed themselves from the primal electricity, we could not guess. Through many compartments of these we passed, and through other compartments that held great pumps that evidently forced the water supplies thus manufactured to every part of Triton's surface.

And we went through compartments, too, in which were other great objects that had puzzled us so completely on Neptune, but whose purpose we saw now. These were the great flat metal containers stacked one upon the other, each a foot or so in depth, and each filled with black, green-shot soil. About them, as on Neptune, were set in the walls great white disks connected to generating apparatus of some kind, but here those generating mechanisms were humming with power, tended by many Neptunians, and there shot from the disks, over and through those great containers of soil, a ceaseless flood of pale violet light or force. And, even as we passed through these compartments, we saw strange and stately pale-green plants bursting up from the soil of the containers, growing at incredible speed before our eyes, attaining a height of inches in but a minute or so! As these strange pale-green plants reached a height of a foot or so, there formed upon them masses of fruits of vegetables dead white in color, some being long and pod-like and others ball-shaped. And as these formed, the attendant Neptunians were swiftly turning off the violet force, pulling the fruit-laden hole plants from the fine soil, and depositing them in low-wheeled containers, which were wheeled instantly away. Then from the framework that held the great soil-containers

there sprayed out upon them fine whitish-green particles that I recognized as seed of some sort, that fell upon the soil and these were turned under it as some reversing mechanism turned over the soil in each container. Then the violet force from the wall-disks was turned on again, and in a moment another crop of pale-green plants was shooting up out of the containers!

It was then that I saw the astounding purpose of those projectors of violet force that were set in the walls around the soil-containers. For it was evident that they shot forth upon the containers a force or vibration which held in it the ultra-violet and other radiations which, in sunlight stimulate the growth of plant-life. These vibrations were projected artificially through the containers of soil with immeasurably greater intensity than in sunlight, and so stimulated the growth of plant-life in these containers immeasurably more. Also I could see that tubes ran from the framework through the soil of the containers, flooding that soil with moisture, and so that water and thus came through special tubular tanks and mixers, it was apparent that it was impregnated with the chemical elements needed by the plant-life in its swift, astounding growth. Thus, stimulated to an intense degree by these influences, the plant-life in these containers could germinate and shoot up and ripen with unbelievable speed. When it was removed, the containers were ready at once for another crop. The whole operation was swift and almost automatic, and as we saw great masses of the white fruits or vegetables being wheeled away from the plant-compartments, we realized at last how the Neptunians, in their great component-disks, obtained a ceaseless and inexhaustible food and water supply.

As we passed on, marveling, we saw other great mechanisms at work. Some were huge and clogged, operated by silent Neptunians before them, turning out ceaseless great blocks of smooth, black stone-like material that composed the intersecting compartment-walls, which peered out as a thick liquid and hardened in molds into that diamond-hard substance. Others were strange-looking machines like none we had seen on Neptune, whose purpose we could not guess. Here and there three glowed in its square compartment one of the great heat-radiating globes, sending currents of intensely warm air rushing out from about it, all the mechanisms of these globes seeming to be cooled inside themselves. Yet even these things were no more wonderful to us than the throngs of Neptunians that swirled and moved in their millions in the great compartment-city about us.

Numberless, indeed, were the herds of those Neptunians, their masses swimming about us in great crowds of disk-bodied, pale-green monsters, busy upon the clanking, beating, hissing mechanisms around them, busy in providing the heat and food and water of their strange world. It seemed impossible, almost, that so many countless millions of them could thus have crowded together on Triton's surface. All were the strange armor or dress of flexible metal around their disk-bodies, some carrying ray-tubes slung in that armor and others various tools or instruments. Here and there we saw one with the same crimson-circle insignia as our leader's upon his metal armor, and it was apparent from the silent deference shown these circle-marked Neptunians that they were officials of some kind. As we marched on behind our leader, our guards close about us, we saw that, despite our strange appearance to them, the Nep-

tunians paid no great attention to us—so busy were they. We saw, too, that here on Triton's seaward side there were no shell-like sleep-compartments at all, all such being upon the dark side. In silent awe and wonder Martin and I moved on through the thronging compartments, countless Neptunians crossing hurriedly all about us, and countless cylinders throbbing through the air above, with the vast roof far above them. Then I sensed that we were approaching our destination.

For before us now, as we crossed a last compartment, there lay that twilight band of disk which marked the division of Triton's dark and sunlit sides, and as we passed out of the pale, dim light of the sunlit side into the twilight of that band, we saw that before us lay a compartment wall that was curving instead of straight, the wall of the great single circular compartment we had worked from above. The compartment that lay between us and that wall was empty save for a file of Neptunian guards who stood motionless along the curving wall with their forearm tubes ready in their grasp. As our leader reached them he halted, spoke with them for a moment in staccato speech, and then as their snapping voices ceased the guards stood aside to right and left and permitted us to pass through the low, broad door in that curving wall. Through it we went, our circle-marked leader first and then Martin and I, our four guards still close about us, and then as we halted inside that door, we two were going with a dejected awe and wonder about us.

We were standing just at the edge of that great circular compartment that we had glimpsed from above, one hundred or so feet in diameter, the twilight about it dimpled somewhat in it by self-glowing disks in its walls. In this great compartment there stood what seemed an immense circular table of metal, only a few feet in height, ring-like in form and with a clear circular space at its center. This great ring-table's edge was not more than a dozen or so feet from the compartment's circular wall, and ranged around it, on low seats between the ring-like table and the wall, were thirty disk-bodied Neptunians. Silent and almost motionless they sat there around the great ring-table, and I saw that upon the metal armor of each was a crimson circle like that of our leader, except that there was a crimson dot at its center, a symbol we had noted on no other Neptunian so far. And from each of the thirty there ran in toward the clear space at the ring-table's center a slender black wire-connection, attached by diverging connections to the body of each of the thirty.

These thirty connections ended at the space at the ring-table's center, running there into a strange object or mechanism that stood in that space. It was composed of a great metal pedestal with straight sides, like an upright pillar, into which the thirty connections ran, while upon the pillar's top was supported a globe of metal somewhat greater in diameter than the pillar, being some five feet across. In this globe's side was a round opening, while set at two other points at opposite sides of it were what seemed insect diaphragms. From the supported globe came a fine hum, scarcely audible, and that was the only sound in the great compartment. The whole scene was strange—the towering black walls of the great circular compartment about us, the great ring-table in it and the thirty silent, motionless disk-bodied Neptunians seated around that table, and the giant globe on its pedestal at the table's central space.

AS we stood there the Neptunian leader before us spoke in sharp snaps, as though explaining our presence, but not to the thirty around the table; it spoke to the great central globe of metal! In amazement we watched him, and then we saw that the globe was turning upon its pedestal, turning toward us a small circle of clear glass set in its opposite side, that surveyed us for the moment exactly like a single calm eye. Then the globe turned again, the opening in its side again facing us, and then from that opening came a staccato answer to our leader, a swift question, apparently, in the snapping speech-sounds of the Neptunians! The globe was hearing our captor's report, was questioning him concerning that report, while the thirty around the table uttered no sound, and turned not toward it!

"Good God!" I muttered at that astounding spectacle. "That globe of metal, Marlin—it hears him, answers him! The thing must be alive!"

"Not alive, Hunt," Marlin said swiftly, his own eyes startled, though. "Those connections that run from the thirty to the globe—they center in that globe's mechanism in some way the minds, the intelligence, of all the thirty!"

Swift light flashed upon me at Marlin's words, and as I gazed astonished toward the thirty Neptunians and the central globe I knew that Marlin's explanation was the only logical one. These thirty Neptunians, it was apparent, were the supreme rulers, the highest council, of all the Neptunian race. And since it was necessary that they use all of their differing minds as one in directing the destinies of their strange race, they had in some way devised a mechanism for that purpose, which synthesized the intelligence, the minds, of the thirty into one single mind by means of that strange mechanism. So that it was literally as one mind that the thirty perceived and thought, when gathered here together, the central globe speaking out the synthesized thoughts and questions of all the thirty!

As Marlin and I stared in amazement toward it, our leader was answering to the globe's questions concerning us, the snapping speech of the Neptunian indistinguishable from that of the mechanism. Then when he had finished, the globe was speaking briefly to him again, a short order, and in answer to that order the Neptunian leader turned at once toward us. I think that both Marlin and myself would not have been surprised to meet then the death that we knew hung over us, but, instead, the leader gestured to us and to our guards and led the way out of the great circular Council Compartment, through a different door from that by which we had entered. As we passed through that door I glanced back and saw the thirty Neptunians of the great Council still sitting motionless and silent around their weird globe-mechanism, which was listening now to the report of three other Neptunians who had entered behind us.

Once out of the great circular compartment, we found ourselves with our guards in an irregular-shaped compartment, filled with Neptunian guards who paired to allow us to pass. Through that and through another rectangular compartment we went, and then into a long oblong compartment in which we could see, despite the twilight that reigned here, were many smaller compartments or divisions along the walls. These were very like cell-compartments, and the low door of each of these was closed by a black slab that slid down across it from above. Before these doors there were paralling in the

long compartment a half-dozen of Neptunian guards, and, after being challenged by these, our own leader and four guards marched us to one of these little cell-compartments, reaching forth to grasp or touch something on its outside wall.

As the Neptunian leader did so, the door of the cell-compartment slid smoothly and silently upward, leaving its opening clear. Without ceremony, then, Marlin and I were motioned to pass inside, and with the four ray-tubes of the guards full upon us we had no choice in the matter. Stepping inside, therefore, we found ourselves in a compartment some ten feet square, whose walls, like all the black walls of the compartment-city, towered for two hundred feet upward around us, the only light the square of dusky sky far above. Then, as Marlin and I stared about us, the door shut smoothly down across the opening, and we heard the soft, shuffling steps of the Neptunian leader and our four guards retreating, outside, leaving us gazing at each other's white faces in silence. Our great mission out to Neptune, our great attempt to save earth and prevent the wrecking of the solar system, had come to an end at last, with our two friends gone and with Marlin and myself imprisoned here beyond all hope of escape on Neptune's peopled moon!

CHAPTER IX

Before the Council

"PRISONED here on Triton—and Whitley and Randall dead! It's the end, Hunt—for us, and for the earth!"

Marlin's voice was but echoing my own thoughts in that moment, and sadly I nodded. "The end—yes. And less than twelve weeks before that end comes, before the sun's rotary speed reaches its critical point, before it divides into a double star. We've found the source of the great ray from Neptune, and we're helpless!"

"Yet the World-President—the World Congress——" Marlin seemed to be thinking aloud. "They sent us out to dare all for earth, and until earth is destroyed or we are dead we can't give up hope."

"But what hope is there?" I asked. "These Neptunians have only relieved us for the moment from death, for their own purposes. Death will be ours before long, and in the meantime who could escape from this place?"

I swept my arm around the cell-compartment, and Marlin considered the place with me as sickly and almost as hopelessly as myself. For it was, truly, a prison inescapable into which we had been thrust. The square little compartment's walls were diamond-hard, of that impenetrable black stone-like substance, and they towered two hundred feet above us. There were in them no windows, the only light that reached us being the dusky illumination that came down to us from the compartment's roofless top, far above. That illumination was but small indeed, for the cell-compartment lay in the same twilight land as the great Council Compartment, that land of twilight lying between Triton's dark and outward sides. By it we could see, however, that the black walls about us were quite vertical and smooth, and that the only break in them was that of the low door-opening, closed now by the smooth, black slab across it.

It was, indeed, a prison from which no efforts of ours, it seemed, could win us free. For even were we to escape from it, we knew, we would but find ourselves in the great compartment-city that covered all Triton, throoped with the Neptunians' countless millions. And even that city, in turn, was held beneath the great metal roof that shilded and enclosed all Triton, so that never, indeed, it seemed, could we hope to be clear of the big moon-world and escape back across the solar system to earth, to all the peoples of earth from what strange source was coming that colossal force-ry that was spinning the sea on to division and doom. Yet, despite that, Marlin and I peered ceaselessly about the little cell in a vain endeavor to formulate some plan of escape.

Our first action was to remove from our feet the heavy-weighted little disks which the Neptunians had fastened upon them, and with those removed we found that we could jump a score of feet upward in our little cell, due to the lesser gravitational power of Triton compared to that of earth, sailing slowly upward and falling as slowly. Yet this increased agility seemed of no avail to us in escaping, since there were no breaks in the surface of the cell's smooth, towering walls by which we might have been able to jump higher. So, after some futile attempts, we rested upon the cell's floor again, re-attaching to our feet for convenience sake the super-heavy little disks, that increased our weight to its normal earth-figure.

"It's useless, Marlin," I said, as we sat here, resting after our efforts. "We can never get out that way—or any other, I think."

"Keep steady, Hart," he told me. "We can't do anything now, it's done, but a chance will come."

"It had best come soon, then," I said. "For with but eighty-odd days left before the end, I see small hope."

He did not reply to that, and I think that the gloom of utter despair that had settled upon us weighed upon him also. They were hours in which there was no change. The twilight that existed here on this band of Triton's surface never changed, its dusk never lightened or darkened. The only sounds to be heard, too, were the occasional staccato voices of the half-dozen Neptunian guards outside, or the answering snapping speech-sounds of other Neptunians, that seemed to be confined in cells like ourselves. Later we were to learn that despite their super-intelligence, perhaps because of it, the Neptunians were afflicted now and then with a brain disorder in which it seemed that a part of their mind's mechanism would cease to function for a time, during which time they were confined in these compartments about us. Save for the staccato speech of these and the guards, and the dull, dim, distant roar of clanking and hammering and hissing mechanisms that came to us from Triton's sunward side, there was no sound in our cell except when cylinders throbbed by overhead.

In those hours the door of our cell never opened, and we found that our food and water were supplied to us inside the cell itself. There were in its wall two metal taps, one of which yielded clear water, that tasted flat and chemical to us. The other gave forth a thick, viscous white liquid, which we recognized after a time as a heated preparation of the white vegetables and fruits we had seen grown so rapidly. This preparation or liquid was apparently pumped through the compartment-city like the water. Thus there was no need for the

guards to enter our cell. It was a number of hours later that there came an interruption to the monotony of evenness of our time, which roused us somewhat from the gloomy apathy of spirit into which we had fallen.

Without warning there sprang into being all about us an intensely brilliant flood of pure white light, that bathed all things about us in its blinding glare. For the moment and then swiftly moved away toward the dark side of Triton. We were stupefied by its appearance thus, and then remembered suddenly the great band of brilliant light that we had seen appear and move swiftly, completely around Triton, marking the end of a ten-hour period and the signal for the sleeping millions of Neptunians on Triton's dark side and the busy millions on its sunward side to change places upon this strange world. Surely enough, in a few moments, the brilliant band of light had swept upon us from the sunward side, having traveled completely around Triton, and dwelling for a moment again upon us, had stepped out of being. That great brilliant band of light, as we were to learn, was produced by great projectors at Triton's two poles, and whirled around it by the turning of those projectors. Now as its brilliant signal swept around the big moon-world, we could hear the countless hordes of the Neptunians shifting from dark side to sunward, and from sunlit side to dark, while overhead there throbbed and shot this way and that innumerable cylinders.

Swiftly as before that great change was accomplished, and then, as there began again the dull clamor of activity upon the sunward side, Marlin and I turned from our listening attention. But at that moment we heard a staccato rattle of speech outside our door, and an instant later the great black slab of that door slid sharply upward and three Neptunians moved inside the cell. The foremost one of those boys on the metal armor of his great green disk-body a crimson circle that marked him as one of the Neptunian officials. The other two were apparently guards brought in as a precautionary measure, their force-ry tubes unshouldered and leveled unhesitatingly upon us. The Neptunian official carried in his grasp a small octagonal object or mechanism with a simple button-control, which we gazed at curiously. He touched the button-control of it, and there sounded from it a series of swift, sharp snaps of sound exactly like those of the Neptunians' staccato speech. Then, speaking aloud himself, he motioned from himself to us, and then to the mechanism.

It was Marlin who first understood his purpose. "The Neptunian language!" he exclaimed. "This one has come to teach it to us, to make it possible for them to communicate with us."

"But the mechanism?" I said. "What is its purpose?"

MARLIN stared at it a moment, then reached forth and touched its round button-control, bringing from the mechanism an irregular succession of snaps of sound. "It's for us!" he said suddenly. "They know that with our different bodies we can't make the sharp, snapping sounds that are their speech, so have brought this mechanism to us to serve us as an artificial voice!"

The Neptunian official, as though he had understood us, motioned again to the mechanism and then from himself to us, at the same time uttering a few speech-sounds as though in explanation. It was plain, indeed, that his object was to teach us the strange Neptunian

speech. Pointing to himself, and to the two guards, he uttered a succession of five sound-snaps, irregularly spaced, over and over again, until it was evident that they represented the name of the Neptunian rocs. Then Marlin and I attempted with the little speaking mechanism to reproduce those five snaps of sound, and after experimenting for a time with the mechanism's button-control we succeeded. Then done, the Neptunian pointed to us and uttered another short succession of sounds, another word, which we then learned to utter on the mechanism also.

Thus, for hour upon hour, the Neptunians continued with us, teaching us word after word, in their strange staccato language. That language, we found, seemed very much like a communication code of dots and dashes, all its sounds or sound-snaps being of the same pitch, there being no raising or lowering of the voice, while for each word there was a certain combination of the sharp sounds. Quickly, too, after a time, we began to understand and learn that strange language, and though never could our own vocal apparatus have produced the clacking bursts of sharp sound which were their speech-sounds, we learned to manipulate easily the little mechanism that spoke to them for us. Hour followed hour and day followed day, until we became so proficient in the knowledge and expression of their words as to be able to communicate effectively, though haltingly, with the great disk-bodied Neptunian who was teaching us.

Yet we found that that ability served us nothing. For though we plied the Neptunian with innumerable questions concerning the great mysteries that we had come through and that lay about us, he would answer nothing. What great chain of events had it been that had made of mighty Neptune's colossal compartment-city a silent desert of death, and that had sent all the Neptunians crowding upon Triton? What was their purpose in directing their mighty force-ray toward the sun, turning the sun ever faster to accomplish its division into a double star? Why, too, had they sent a second great force-ray out in an opposite direction from the first, passing out into the vast void of interstellar space? These questions we put many times to the great Neptunian who taught us, but the big, green-bodied disk-monster simply contemplated us as though unhearingly with his bulging, glassy eyes, and went on with the teaching of their strange speech.

So days followed days while we slowly progressed in our learning of the Neptunian speech, days in which the despair that had gathered in our hearts grew darker and darker. For at last, when more than a score of earth-days had passed, we realized that all was hopeless indeed, that even had we managed to escape, even had we still our space-flier that had been destroyed with Whately and Randall, we would hardly have time enough to return from Neptune to earth and bring back the fleet of space-fliers that were being prepared on earth. Not much more than a half-hundred days, indeed, remained before that last day that would see the sun splitting at last to engulf almost all its planets, for with each day, we knew, the giant force-ray of the Neptunians emanating from Triton was turning the sun faster and faster.

Twice, indeed, I almost made a wild attempt to overcome our Neptunian teacher and guards, but was held back by Marlin, who knew as well as I that instant death only could result from such an attempt. And as those

days passed, as with each ten hours the great band of light went around Triton and the millions of Neptunians on deck and starboard sides interchanged, I came to look on death as a release from the agony of suspense and torture in which we were. I think that not much longer could either Marlin or I have endured the terrible torture of that imprisonment, when there came at last a break to it, on the twenty-second day of our captivity.

On that day, as we waited in the unchanging twilight for the coming of our Neptunian teacher and his two guards, we were astonished when the door slid up to find facing us outside a different Neptunian official, of the same insignia of the crimson circle, with four guards behind him instead of two. He did not speak to us, but motioned us silently to move outside, and as we did so he gestured to Marlin to take with us the small speech-mechanism by which we were able to converse with the Neptunians. Then, guarded closely before and behind, our attempted escape in the cylinder having kept the Neptunians extremely watchful of us ever since, we were marched out of the long oblong compartments of the cells and across others toward the great circular Council Compartment. Into it we were marched, and found that, as before, there sat around the great ring-table the thirty silent members of the Council, the great metal globe still on its pedestal at their center. They did not turn toward us as we entered and halted beside them, but the great globe did, turning first the single gleaming eye upon us by means of which, we knew, all the matted minds of the thirty members of the Council were receiving a visual impression of us.

Then the globe turned swiftly so that its speech-opening faced us, and it spoke to us, spoke as the assembled minds of the thirty, with all emotions removed and with all thoughts synthesized by its mechanism. "You are the two creatures captured upon our world?" it asked. "And you have been taught our language as we ordered?"

Marlin pressed the button of the little mechanism in his grasp, speaking back in the same snapping speech-sounds by means of it. "We are those two," he said simply.

The globe was silent a moment, then spoke on, the thirty whose minds spoke through it never turning. "When you two were captured upon our great world, others, no doubt like you, were discovered in a space-vehicle which it was apparent, was operated by the same principle of force-rays which we of Neptune (it was their own word-equivalent for the name of the planet) have long used in our own space-vehicles, and in other ways. That vehicle and those inside it, it has been reported to us, were destroyed by those who discovered it, but we desire to know from whence it and you two came, and in what way you were able to reproduce the force-rays which we of Neptune have long used. From the structure of your bodies it is apparent that you come from a small planet, in all probability the second or third of the sun's worlds. But from which, and why, have you come here?"

Marlin did not answer for some moments, then spoke back through the little mechanism he held. "It is from the sun's third world, indeed, that we have come," he said. "And we have come here, have plunged out through the void to this, the sun's outermost world, to find out why you of Neptune are looting doom on the solar system with that great force-ray of yours that

spins the sun over faster, and to use all our power to halt that doom!"

IN that tense moment a thrill of irrepressible pride shot through me, even in the dark peril in which we stood, at Marlin's words. For they were not his alone; they were the words of earth, the words of earth and all its races to Neptune and all its hordes! And so that bold defiance, flung across the void from world to world and issuing here from Marlin in the very face of this supreme Council of the Neptunian rulers, of this great globe-mechanics that held their gathered, synthesized minds for the time being, as order to the guards behind us for our instant death would not have surprised me. Yet here again we were given proof of the difference between the mind-workings of the Neptunians and ourselves. It was evident that the human passions of hate and anger held small place in their cold, machine-like minds, for the great globe that spoke for the minds of the assembled thirty was silent for a time, and when it did speak it seemed not to regard the passion of Marlin's words.

"When you speak of halting the doom that confronts your world," it said, "it is apparent that you do not know the necessity of that doom, the great necessity which has caused our races of Neptunians, under the direction of the Council of Thirty, to loose that doom upon the solar system. Learn now, therefore, that it is to save our own world, our own races, that we are loosing this death upon the sun's other worlds and peoples!"

The great globe again was silent for a moment, the thirty members of the Council silent around it as their assembled minds poured their thoughts into its mechanism, to be released in a single voice. Marlin and I stood there at the great ring-belt's edge, and surely no stranger scene could have been imagined than that, with the great circular compartment's towering black walls around us, the twilight that reigned above and around, the thirty silent disk-bosomed Neptunians and our own disk-bosomed guards, and the great, enigmatic globe-mechanism before us, that spoke and listened as a living thing, representing the massed minds of the thirty. And now that great globe was speaking to us again, in the staccato Neptunian speech.

"It is most wise, perhaps," it said, "that you two of another world learn now what colossal forces and necessities lie behind the loosing of that great doom which you come to stave vainly against. It is most wise that you learn now how useless it is for you or any of your world to oppose yourselves in the plans of us Neptunians. For we of Neptune are of an ancient power and might, beside which you of the inner planets are as newborn children. And lest you doubt that power, lest you doubt the colossal forces that we of Neptune have called into being and use for our own purposes, we of the Council tell you now what mighty part is ours.

"Oldest of all the eight worlds of this solar system, indeed, is our world of Neptune. This you must know, indeed, if your scientists know aught of the formation of the sun's planets. For those eight planets were formed undilutable eons ago, out of the fiery sun itself. Up to that time the sun had moved through space entirely without planets, one of the countless stars of this galaxy of stars, all moving through the void in differing directions. One of these other stars chanced to be moving in the general direction of our own star, our own

sun, and their mutual attraction for each other drew them closer together, until at last they passed each other closely, perhaps even touched each other, their nervous to each other causing by gravitational attraction huge masses of the flaming gaseous substance of each to break loose. Thus the space between the two passing suns was filled with those great flaming masses, and as they separated, each by its gravitational power drew a share of those fiery masses with it on its path through the void.

"Thus when the two suns receded from each other once more, each carried with it a rough half of the fiery masses that had been torn from each. As the sun moved on through space with those fiery masses about it, the greater part of them dropped back into the sun. The flaming masses that remained, however, had been thrown by the catalysis into a swift motion, which by the sun's attraction had been converted in the case of each flaming mass into a circular or elliptical orbit around the sun. And since the speed of each flaming mass just balanced with its centrifugal force the pull of the sun inward, they continued in those orbits for age on age without perceptible change. The solar system, then, had become stable.

"Thus the sun was moving on through space with eight great flaming masses of matter revolving around it, in addition to a number of great clouds or aggregations of smaller fragments. These eight flaming masses became in time the sun's eight worlds, a solid crust forming first on one and then on another of them. The outcome of these great fiery masses was that which in time was to become the planet Neptune. It had been one of the first of the great fragments of the two suns torn loose by their encounter, and being one of the first had been hurled out to a greater distance than any of the others. And being the first, too, it had had more time to cool, its solid crust had formed earlier on it, and thus Neptune was in fact the oldest of the sun's planets to form as a solid-surfaced world. Neptune, too, is composed of much lighter materials than the denser inner planets, and the reason for that is, that it was the lighter matter of the two suns that had normally been sent flying forth from them in their encounter; and thus the outer planets, the four great outer worlds, being of the sun's lighter matter, are all much less in density than the four smaller inner worlds, which were thrown forth later from the sun's heavier matter, and thus in smaller masses.

"So out of the great irregular-shaped outermost mass of flaming gases had been formed the great planet Neptune and its smaller moon of Triton. And as Neptune's surface solidified, as the great masses of water-vapor and air that made up its dense and immense atmosphere encathed it, it became a habitable world, one fit for life and the continuation of life. For though small heat came to distant Neptune across the great void of almost three billion miles that separated it from the sun, the sun giving it indeed a heat hardly perceptible, yet there was heat enough for the great world in its own fiery interior. For so great in size was Neptune that, though a solid crust had formed upon it, there still lay beneath that crust the vast raging fires of its interior, and those fires' heat was so great that they kept the surface of Neptune and the dense atmosphere above that surface warmed constantly. And Triton had an atmosphere also and interior warming fires.

"Thus great Neptune, though furthest of all planets from the sun, became habitable the earliest of all. And since, wherever a world is found on which life is possible, life sooner or later will arise, so it arose on Neptune. Risen upon man of living creatures rose upon it, and race after race vanished, annihilated by changing conditions on its surface which they could not withstand. It was not until we disk-bodied Neptunians evolved upon the great world's surface, indeed, that there came a permanent form of life upon it. For we, whose disk-bodies owed their squat, flat shapes to the gravitational power of Neptune, so much greater than that of your inner worlds, had in larger measure that spark of intelligence which the other creatures had lacked. And with that gleam of mind, of intelligence, we were able to withstand the changing conditions on Neptune's surface by adapting ourselves to these conditions, growing ever in numbers and spreading out over our world's surface, until at last we numbered in millions upon it and were rising into greater and greater comprehension of the universe about us, into greater and greater intelligence and power.

"**G**REAT buildings we built upon Neptune's surface, and deep we tunnelled below its surface, also. Through breaks in the great cloud-screen about our world we looked forth and saw with our instruments the other planets that moved about our sun, and looked forth also into space and saw the hosts of other suns that moved at vast distances from our own. Our eyes were accustomed to the dim Neptunian day, our bodies to its great gravitational power, and it was our home-world. Yet by this time to vast had become our numbers that millions of us were crowded too closely together, and desired to migrate to Triton, our moon, and settle there. And though we had never yet been able to sally forth from the surface of our own great world of Neptune, we found the way to do so thus.

"That way was given to us by the discovery by our scientists of a new force-vibration, one that lay in wave-length between the light vibrations and the higher electrical vibrations. This force-vibration, they found, exerted a definite pressure or force upon any object struck by its waves, just as the light rays themselves exert a definite, though far smaller, pressure upon whatever matter they strike. With this new force-way, therefore, we planned to propel vehicles through space, and we constructed great cylindrical vehicles which were to hurtle out into space by generating inside them a great force-ray which would be shot back against a world and thus propel them by repulsion away from that world. These cylinders were made and tested, and since they worked perfectly, we constructed many of them, enough to take out all the millions of our surplus population to Triton. And so in these cylinders those millions of Neptunians went hurtling out to Triton.

"They found, as our observations had shown to, that Triton had a good atmosphere, and that it was swarming already with many forms of life, some of them wretchedly grotesque, and none of more than the lowest intelligence. Using weapons of concentrated force-rays, which drove through all they touched, our millions of Neptunians proceeded to annihilate all life upon Triton, and with that accomplished, proceeded to build for themselves structures and cities like those on Neptune. They found that Triton was a perfectly habitable world for

them save for two considerations. One of these was the lesser gravitational power of it, which made it extremely inconvenient for them to move on it with their Neptunian muscles. They solved this problem by attaching to their limbs small and unobtrusive disks of an extremely heavy metal which we could make by the artificial mixing of atom-protons without electrons. These disks increased their weight to such a point that they could move as freely and conveniently on Triton as on Neptune.

"The other problem facing them on Triton was the fact that it turned one face always toward the sun. Its rotation on its axis, indeed, was of just enough speed to counteract its revolution around Neptune and Neptune's own revolution around the sun, the sun itself of its movements resulting in this keeping of one side always toward the sun, with that side always puffy by the sun and the other always in darkness. Even when Triton was behind Neptune, invisible perhaps from your own world by reason of the edge of Neptune's great atmosphere projecting up to hide it somewhat, Triton's orbit was so slanted or inclined toward the plane of the solar system that the sun was always in sight of its upward side, though dimmed a little when the edge of Neptune's atmosphere was between them. The Neptunians who had gone to Triton were accustomed to Neptune's alternating day and night, of approximately ten hours each, and so they solved the problem by living upon the sunlit side of Triton for ten hours, for a day, and then passing to the dark side for ten hours of night.

"Thus they had conquered all the inconveniences that had faced them in settling upon Triton, and so upon Triton as upon Neptune were Neptunians and their cities. The civilization of both Neptune and its circling moon seemed secure and unchangeable, indeed; a civilization that existed upon our world and its moon when all the other planets of the solar system held only the lowest forms of life, if life they held at all. Easily could we of Neptune have ventured into the sun's other worlds had we wished, in our space-cylinders, but we had no desire to do so, having learned all that we wanted of those worlds by observation with our instruments, and being content to remain safe upon our great world of Neptune and smaller moon-world of Triton. And safe we remained there, for ages, yet, during all those ages, there was coming closer toward us a great crisis which we had long before foreseen, yet which we had considered so remote a peril as to give it no attention.

"But now that peril had become close, and great. And it was none other than the extinction of all life on both Neptune and Triton that faced us, due to their steady cooling. For all worlds, however fiery their interior and in time and die. And steadily, surely, the interior fires of both Neptune and its moon had been cooling and the substance solidifying. Already they had cooled so far that the surface of Neptune was much colder than ever before, and that of Triton also, and with each passing century that cold was increasing. It would be a matter of time only, it was plain, before both Neptune and its moon would be utterly without life, a terrible frigidly reigning upon each, all life perished from them in that bitter cold. For though worlds nearer the sun might exist by means of the sun's heat, though life on them could cling to existence through the sun's warmth, Neptune and its moon were so unthinkably distant from the sun that almost no heat reached them from it, and

as their interior fires cooled, they must inevitably become so cold as to annihilate all life upon them!

"It was evident that some great plan must be adopted that would prevent this condition, and such a plan was quickly decided upon. This plan was to enclose both Neptune and Triton with great roofs of metal that would hold in them the heat that was being radiated out, and that would make it possible to add the falling heat of the two worlds by artificial means. It would be a gigantic task to place those great roofs about Neptune and Triton, but we set to work upon it and for years upon years all the energies of the Neptunians were centered upon the construction of those roofs. We had established vast workshops in which the pieces of metal that were to form the great roofs were turned conscientiously forth, and these in turn were joined together to make the great roof of giant Neptune.

"It had been decided that this great roof that was to enclose Neptune would have no supports whatever. For that roof was to be in effect a gigantic spherical shell enclosing Neptune, and as such it would float in space around Neptune without touching it at any spot, since the attraction of Neptune upon the roof would be the same in all parts; thus it would not be pulled to this side or that, and would not touch the great planet in any place. The small attraction of the sun and the other heavenly bodies on the free-floating spherical enclosure was nullified by an automatic force-ray pressing against the inside of the roof in the right direction, and thus the giant spherical shell could enclose Neptune, and could float about it, moving with it through space, without touching it at any point!

"The metal plates, that had been joined together to make the vast spherical shell, were of a strength to resist all stresses, and they had been specially treated by a crystallizing process that gave them a unique property. This was the property of admitting all heat and light vibrations from above through them, but repelling those from below. Thus when the great roof was in place around Neptune, enclosing it completely, the sun's light and heat penetrated down to it through the roof without check, making the roof seem transparent from below. But no light or heat vibrations could pass up through the roof from beneath, so that it appeared quite opaque from above. Thus when light and heat the sun furnished were not lost, and Neptune's day not darkened. But very little of that heat of Neptune itself could be radiated outward into space.

"With the great roof in place around Neptune, and with openings that could be opened and closed at will provided in it, for entrance to or exit from Neptune, a similar roof, though far smaller, was constructed around the smaller globe of Triton. With these great enclosures thus shielding Neptune and Triton, therefore, their cooling was slowed, and it seemed to all that the exponent of the great roofs had warded off the menacing cold that had threatened to extinguish all life on Neptune and Triton. Strange new cities were built on Neptune and Triton, great compartment-cities that needed not roofs with the great roof above them. New methods were found of producing vast food supplies for the crowding millions of Neptunians, by stimulating with electrical force and chemicals the growth of vegetation to an unbelievably swift rate. Thus we Neptunians, in our giant enclosed world of Neptune and in our enclosed moon, Triton, had checked the coldest peril that

had threatened us and could continue to live safely upon Neptune and its moon for ages upon passing ages!"

CHAPTER X

To Split the Sun!

"WE had checked the great peril that had hung over us, but we found, as the centuries and ages passed, that we had only checked it, that we had not banished it. For nothing in the universe could halt the cooling of Neptune and Triton. As their interior fires cooled, colder and colder grew their surfaces, despite the roofs that enclosed them. It was then that we had recourse to another means of halting that menacing cold—the use of artificial heat. We set up in the giant compartment-city of Neptune, and in that of Triton also, great globes that radiated out unceasing and intense heat. These globes held inside them their own mechanisms, mechanisms that could change etheric vibrations of electricity and light and others into heat-vibrations, by changing their wavelength. And with these radiating their ceaseless heat, and with the great enclosing roofs, the menacing cold was again checked.

"Yet after a time we were forced to recognize that this check also was but temporary. For we were fighting the most grim and hopeless battle in the universe; we were fighting against the relentless and inevitable changes caused by the immutable physical laws of the universe. So that, aid its falling heat as we might with artificial heat-producers, the interior heat of Neptune was waning still, and more and more globe heat-radiators were required to keep the temperature of Neptune at its usual height. The Neptunians of Triton were faced with the same problem, but their situation was not so desperate as of those upon Neptune, since though Triton had cooled as quickly, its enclosed space was so much smaller than Neptune's, its great roof so close to it also, that it was possible with an effort to keep enough heat-mechanisms going there to maintain the warmth.

"On Neptune, however, that struggle became more and more desperate, our great struggle against the blind laws of nature. For as Neptune's interior heat declined farther and farther, it became more and more impossible for us to keep enough heat-mechanisms going to keep it warm enough for life. And at last, after years upon years of that awful struggle against fate, we of Neptune realized at last that it was no longer possible to keep Neptune warm enough for us to exist there, and that we must leave it at once for some other world if we were to escape extinction; since as the great planet's interior heat declined, it became more and more appalling for us to keep enough heat for life by means of the heat-mechanisms, and it was clear to all that the end was at hand unless we left Neptune!

"But where could we go? Even if one of the other planets were suitable to receive us, we could not have transported all our masses from Neptune to another planet in time to escape the doom of cold and death that was closing down upon Neptune. To transport all those masses would have required countless trips with our limited number of cylinders. And to take refuge upon another planet, even had time been ours, was absent out of the question. For long our scientists had studied the other planets with their instruments, and though some of them were so cloud-wreathed and others so dis-

tant as to make observation difficult, it had long been known to us that none of the other planets, due to their natural conditions or to the presence of intelligent alien beings already upon them, would be possible as a world for us Neptunians. It was for those reasons, indeed, that no expeditions of cylinders had ever been sent to the other planets.

"There remained, then, but one place where we might go, but one place to which our millions might go before Neptune's cold grew too great for life. That place was Triton, our peopled moon. For peopled as that moon was with its own masses of Neptunians, struggling against the same menacing cold that had vanquished us on Neptune, it was the one refuge for our peoples. By crowding into its every corner, the countless millions of Neptune's peoples would be able to exist upon Triton. And though the cooling of Triton had increased it with cold also, it has been found, as we have mentioned, that it was not so hard to keep Triton warm by means of the artificial globe-like heat-mechanisms, the space mechanism by its great spherical roof being much smaller. It was a desperate expedient, truly, to mass all the thronging millions from the compartment-city that covered all giant Neptune, to mass all those millions upon little Triton, yet that was the one expedient open, and so it was followed at once.

"Out from Neptune to Triton went all the cylinders of both worlds, loaded with as many Neptunians as they could carry, depositing those Neptunians upon Triton and racing back for more. Complete trips made those thousands of cylinders, trip after swift trip, each occupying but little time because Triton was so near. And so at last there came a day when the whole of Neptune's millions had been transported out to Triton, when there remained on Neptune itself no single one of our races, our giant world lying cold and deserted and dead, no longer a habitable world, its vast compartment-city empty of the millions that had for ages swarmed through it, while all those millions were crowded now upon little Triton.

"And so crowded were those vast hordes of the Neptunian races that for a time it seemed that they could not exist in such numbers upon Triton. This crowding was made less acute, however, by an expedient now adopted by us. As mentioned, the Neptunians who had settled upon Triton long before had found that the unchanging day on one side of it and the unchanging night on the other were inconvenient for them after the alternations of Neptune's day and night, and so had begun the custom of spending a day of ten hours upon the sunlit side of Triton and a night of equal length upon the dark side. And now we found that we could make the crowding of our races upon Triton less acute by having half of them working and active upon the sunward side for ten hours while the other half slept through their night on the dark side. Every ten hours these two halves of our people changed sides, changed from day to night, a signal having been devised to mark the hour for that change, a signal which consisted of a brilliant band of intense light, that passed swiftly around both Triton's dark and sunward sides. With this shifting of our peoples each ten hours it was possible to make use of all of Triton's surface, and thus the crowding of our peoples upon it was made less acute.

"Yet that crowding was still very great. All the thronging Neptunians that had existed upon the surface

of great Neptune had been poured out on little Triton, far, far less in size than its great parent-world. And thus, though they could exist upon it, it was existence only that was possible to the Neptunians on Triton, since this awful crowding would grow worse, we knew, rather than better. And also, and more important, here on Triton the same deadly menace that had driven us from Neptune was again confronting us. For even as Neptune had cooled, Triton had cooled, was cooling also. And though we studied every effort to keep the warmth in Triton constant, though we sent cylinders constantly back to dead and deserted Neptune to bring from it more heat-mechanisms and other needed mechanisms, we found that even as on Neptune we were fighting a losing battle with nature. For Triton was cooling, was cooling still farther, and soon would be completely cold and dead, its interior heat gone out into space. And when that happened, no number of heat-mechanisms could keep warmth upon it, even beneath the great enclosing roof, and all life on it must perish.

"The Neptunian races had come to their last stand! Crowded upon our refuge of Triton, striving with all our power to keep upon it the warmth, without which we could not live, we saw at last that some new and radically different plan must be found, or we could no longer exist. So all the greatest of our Neptunian scientists were called together by us, the Council of Thirty. Into a great conference here on Triton they were called, and to them, without equivocation of any sort, and to the races of the Neptunians, the situation that confronted us was stated. We had been driven from Neptune by the relentless growing cold, and now that same cold was upon us here at Triton, was threatening us here also with annihilation. How were we to meet this great menace that threatened to wipe us out?

"COUNTLESS were the plans that were advanced in answer to that menace by our scientists. The first, and most obvious plan, was migration to another planet. But here we were checked by the same considerations that had made us unwilling to try that before, for we knew by observation of the other planets that upon none of these could we live as we lived upon Neptune. Some of them were greater in size than Neptune, with greater gravitational power, and that was a difficulty that could not be overcome by us since upon those planets our weight would be so increased as to make us helpless, even had those planets been fit for our life. Some planets were peopled by indignant and powerful races which we might be able to conquer after terrible struggles. Others were too near the sun for us to ever inhabit them, who had evolved on the dim, cool world of Neptune, the outermost world. Other planets, as far as we could tell, were quite uninhabitable. Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus— not one of them was suitable as a world for us Neptunians. And we had, also, no desire to move to another planet, in truth, since as many ages had it taken for us to build our great compartment-cities upon Neptune and Triton, to shield them with their great roofs, that it was impossible for us to leave them, even had we been able to start anew upon another world.

"We must remain with our own great world, it was plain, but how then could we continue to live? Innumerable were the suggestions that were advanced, but even those who advanced them were forced to admit

them impossible. Scores upon scores of useless plans were submitted to us, but none held even a shadow of hope for us, and it was not until we of the Council of Thirty had come to despair almost of warding off the doom that threatened us, that a plan was finally advanced by which that doom could indeed be halted.

"That plan, put forth by three of our Neptunian scientists in cooperation, was one of such colossal nature that even we Neptunians, who had rooded our world and had fought for so long the forces of nature, were stricken by it. These three Neptunian scientists, in stating their plan, stated first that it was apparent to all that no escape to other planets was possible for us, and that our roots must remain at Neptune and its moon, for life or death. They stated that it was equally clear that no means could be found by which even Triton could be kept heated artificially, all such means suggested requiring such vast expenditures of energy as to make them impossible for any but the shortest period of time. These promises, they said, were clear linked, and it was equally clear that unless a new source of heat were found in some way for Neptune and its moon, we means of Neptunians must finally die. And so these three suggested a source of heat that never even had occurred to any of the rest of us, suggested—the sun!

"The sun as a source of heat for us! The idea seemed incredible to us—the Council of Thirty. For to us of Neptune, lying so far out in space from the sun, that sun could never mean and had never meant what it does to you of the inner planets. To you it is a source of ceaseless blaring heat, of brilliant light, warming your worlds sometimes to scorching, no doubt. But to us that sun has seemed always but a tiny little disk of fire far off in the void from us, a little sun-disk that gives to us the dim light of our pale Neptunian day, but that gives to us hardly any measurable heat whatever. We had simply never thought of the sun at all as a source of heat, any more than you would think of a star as a source of heat, since we had been accustomed always to rely upon the interior heat of Neptune for our existence. But now with that interior heat gone, with Neptune cold and dead beneath the zero temperatures that reigned there, and with Triton fast approaching the same condition, these three Neptunian scientists advanced the sun as a possible source of heat that might save us.

"The sun, they admitted, was too infinitely far from us to help us any with its heat as conditions were. But what, they asked, if the sun were to divide into a double or multiple star? Countless stars of the universe, we knew, had done so, had split into a double or triple or multiple star, and in so dividing, by reason of their rotary speed or centrifugal force growing so great as to make it impossible for them to hold together, the two or more small stars forming out of one always moved some distance apart from each other, by the first force of their division. If the sun were to divide into a double star, therefore, the two smaller stars that would be formed thus would undoubtedly follow the same course, would be pushed apart from each other by the very force of their division, some two billion miles, our astronomers had calculated.

"Pushed apart thus, the two new suns would form an ordinary double star, or binary, the two revolving around each other. And by their division almost all the planets of the solar system would without doubt be engulfed in one or the other of the two suns. The four inner planets

would inevitably be annihilated when the sun split into two suns, when those two rushed apart from each other. For if they were not directly in the path of the two separating suns, they would be drawn into those separating suns almost at once by the tremendous gravitational disturbances attendant upon this tremendous cataclysm. They would have no more chance of life, indeed, than snails in a great blast. And in the same way Jupiter and Saturn would be whirled out of their orbits, since those orbits would be fatally confused and changed by the first division of the sun, and by the loss of centrifugal force attendant upon their confused slowing they, too, would without doubt be drawn into the path of one or the other of the separating suns and perish in them. And even Uranus would meet a doom as inevitable, since with a distance of two billion miles between them the two new suns would be racing almost exactly upon Uranus' orbit, and so that world too would go to blazing death in one or the other of them.

"But Neptune would not! For Neptune, farther out than Uranus, farthest out of all the planets, would be the one planet in the solar system that would escape the tremendous cataclysm, due to its distance from the sun. When the two suns separated, Neptune's orbit would probably change a little, it would probably sweep closer in toward those suns for some distance, but except for that it would be unchanged, and would by reason of its great distance continue to circle in its curving path through space, but would circle then around these two new suns instead of around the former single sun. And with these two suns separated as they were, by a distance of two billion miles, Neptune would be near always to one of those suns, because it would undoubtedly sweep nearer to them when the cataclysm occurred, and would take up an elliptical orbit about them with the two suns as the foci of that ellipse. Thus it would always be near enough one of them to gain from it or from both a large amount of heat! For not only would Neptune in its elliptical orbit be far, far closer to them than, but the other planets hurrying into them would tend to make them hotter. Thus Neptune, revolving close about the two suns, would gain from them the warm, life-giving heat that it had never gained from the single sun!

"That heat would thus solve the great problem that faced us; it would halt the doom that was closing down on us. For that heat would so warm Neptune, that we could go back again and take up our existence once more upon it free from all peril, could live again in that great compartment-city that covered all Neptune. And Triton, too, would be livable, then. For the great reefs that we had created around Neptune and its moon would tend to make of both worlds great hot-houses in effect, the sun's or suns' heat being able to penetrate down through those reefs. And with those enclosing reefs about us, and with the two new suns close, we could live on in safety. For the enclosing reefs themselves would prevent any inconvenience from the fact that Neptune now and then would be farther from the two suns than at other times, those great reefs keeping a constant warmth upon Neptune and its moon.

"Thus all the great peril that confronted us would be thrust back, and we could live once more on Neptune, more warm and comfortable there than ever before; we could pour back once more to our mighty world that lay now dead and cold and deserted—could do all this, if the sun did divide into a double star. Yet what hope was

these that this could happen? We knew that the reason other stars of the universe divide into double or multiple stars is because they have reached a rate of rotary speed that makes it impossible for them longer to hold together. For when a sun is spinning its mass tends to split up by its own centrifugal force, just as a turning wheel, and the faster the sun spins the greater grows its centrifugal force, the greater its tendency to split. And then at last that rate of spin grows so great, and its centrifugal force is such that its mass can no longer hold together, and fission takes place, the sun dividing into two or three or even more stars, that push apart from each other. But what chance was there of the sun doing this? For the sun, we knew, rotated at the speed of one turn in 25 days, at its equator, and to split it would have to be rotating at a speed of one turn in an hour. That meant that it would be unthinkable even before the sun's rotary speed would have increased to that point. For though a sun's rotary speed does increase as time passes, due to the shrinkage of its mass, it increases so infinitely slowly that it would be some, indeed, before the sun's rate of spin would be so great as to cause its division. And thus there seemed small hope indeed in that plan.

“**T**HEN it was that those scientists revealed to us the heart of their plan, and made clear to us the true colossal nature of their suggestion. What, they asked, if we ourselves increase the sun's rotary speed? What if we of Neptune should reach across the void of almost three billion miles and set the sun to spinning faster, spinning it ever faster and faster until it had reached the critical point, until it turned once in one hour? Fission would result then, the sun would divide into a double star as they had calculated, and all the benefits mentioned would come to us, and Neptune and its moon would be hurried always by the heat of the two stars about which they would revolve. If we could do that, if we could reach across the void and set the sun to spinning ever faster, it would soon divide into two new suns, and thus we would have saved ourselves. Yet we were thunderstruck by this suggestion of the Neptunian scientists. To reach out across the infinite leagues of space that lay between our outermost planet and the sun, to turn that sun ever faster until it split into a double star—how ever could such a gigantic, stupefying feat as that be accomplished?”

“But the Neptunians who had suggested this plan now calmly explained how that colossal deed could be accomplished. Long before, indeed, we had discovered force-vibrations, finding them a vibration that entered tangible and definite pressure or force upon whatever matter they struck. And we had used those force-rays in some ways. We had used them to propel our cylindrical vehicles out through space from Neptune to Triton, and vice versa. We had used them also, concentrated into slender, pencil-like rays of great power, as weapons, since those concentrated rays penetrated and destroyed all that they touched. Now our scientists proposed to use them for this huge plan—to reach across the void, across the solar system, and to turn the sun ever faster, until the desired division of it had happened.

“Nor was this, as they outlined it, impracticable. The sun, turning there in space at the center of the solar system, has naturally one edge or limb turning away from us, and the other turning toward us. Now, if we

constructed colossal generators of the force-vibrations, generators that could produce a gigantic ray that would have almost incalculable power, and shot that ray across the solar system toward the edge of the sun turning away from us, what would happen? It was clear that that great ray, striking against the side of the sun's mass turning away from us, striking that side with terrific pressure and force, would tend to turn that side faster away from us, would tend in that way to make the whole sun turn faster! Such a gigantic ray, though it would increase the sun's spin but slowly, would continue to increase the sun's spin steadily as long as it was kept turned upon the sun's side. Slowly, but steadily, the sun would turn ever faster, until soon it would have reached that critical rotary speed, of one turn in one hour, that would make its centrifugal force so great as to make it divide into a double star, and so save us of Neptune from the cold death that hung over us.

“Thus this mighty plan was presented to us, and it was at once accepted by us of the Council of Thirty, by all of the Neptunian races. For we saw that in it lay our one chance for life, our one chance to halt the doom of our races, our worlds, and to halt that doom we were willing to make any effort. We knew that the other planets of the solar system, that the seven other worlds of this universe and all their moons, would go to flaming death when our plan succeeded, would be annihilated when the sun divided, but we recked not of that. For the last necessity was upon us, the last closing down of the doom that we had fought against so long, and to remove the shadow of that doom from over us, we were willing to send to a more terrible doom all the other planets of the solar system.

“Only one great difficulty lay before us. That gigantic ray could be generated and shot forth by us, since it would not be difficult, by concentrating all efforts, to construct the generators and mechanisms needed, but from what place was that ray to be shot toward the sun? And how? It was evident that the great ray could not be sent from Neptune's surface. For not only would it be almost impossible to keep its great mechanism working in the constant terrible cold that reigned there, but Neptune's rotation would make it impossible to send the ray forth from any spot on the great planet, since because of Neptune's rotation, it would follow that that spot—that great ray, would be toward the sun half the time, on Neptune's sunward side, and the other half would have turned and point away into space from its dark or outer side. It was apparent, therefore, that the great ray could not be sent forth from Neptune, since to achieve its effect that ray must play constantly upon the sun's one side or edge; and it became apparent that only from Triton could it be sent forth, since Triton kept one face always toward the sun and it would therefore be necessary only to set the great ray's mechanism in that sunward side, when it would point unchangingly toward it.

“As far as position was involved, therefore, it was quite feasible to drive the colossal force-ray out from Triton's sunward side toward the sun. But there was another point involved, one that laid fair to ruin the whole great plan. When this gigantic force-ray reached out across the gulf, and struck the sun, it would push the sun's side with incalculable power, as was planned, with a power great enough to turn that sun's disk mass faster. It would be, in effect, like a solid arm reaching

forth from Triton to press against the sun's edge. But the sun is gigantic, its millions of times greater in mass than Triton, and so what would be the result of that great pressure of the ray? It would, without doubt, turn the huge mass of the sun with that pressure very slowly, but it would, by that pressure and by its reaction, push back against the infinitely smaller mass of Triton itself, and push it away from the sun; it would push it back away from the sun with such colossal power that Triton would be torn loose from the grip of Neptune, its parent-world; would be torn loose almost instantly from the solar system itself, and would be hurled straight out into the awful void of interstellar space away from the sun and all its planetary worlds!

"It was the same principle, indeed, as that of our cylindrical space-fliers. These cylinders, generating inside themselves a powerful force-ray, shot that force-ray down against the planet upon which they were. But that force-ray striking with great pressure from the comparatively tiny cylinder to the great planet, did not move the planet, of course, with its push. It moved instead the cylinder itself, hurling it upward from the planet because its mass was so infinitely smaller than the planet's. And it would be the same way with Triton and the sun. For Triton, sending forth the great force-ray generated upon it, toward the burning sun's edge, pressing against the sun's huge mass with colossal power, would not move the sun, would not turn it noticeably faster as we planned, but would move Triton itself out from the solar system into the void of space! Almost instantly, by that terrific push, Triton would be hurled out into the awful gulf of space, and thus by that terrific push outward would be torn loose from the attraction of the sun and its planets forever, and would by its own inertia shoot out through the interstellar void for all time! That meant, of course, death for all the massed Neptunian races upon Triton, since in the darkest, awful void of space outside our universe, our solar system, they would at once perish!

"This seemed, indeed, the difficulty, which was to make our great plan impossible. But with only that obstacle standing between us and success, we did not despair, but sought to overcome it. And at last we found a remedy for this difficulty, found a means by which it might be overcome. Triton would be pushed out into the gulf of space away from the solar system forever, when its great force-ray struck the sun's edge. But what, it was asked, if Triton were braced against the push outward of that great ray, were braced by a great force-ray of equal colossal power shooting out from it in an opposite direction against some great mass, sending in that way to push Triton inward toward the sun even as the great ray striking the sun would tend to push it outward? The result would be obviously, that Triton would be pushed on either side by the two opposing great force-rays with equal power, and being so pushed between them it would not move either inward or outward. And thus being immovable, being braced against the pressure of the ray shot toward the sun by the pressure of the ray shot out into the void against as great a mass, Triton's ray striking the sun's edge would, as we desired, turn that sun faster and faster, spin its huge mass faster without affecting Triton itself! For, the two great rays being so exactly balanced in power, Triton would not be affected in the least in its own position or motion.

"There was needed, then, only a second great force-ray to go out into space opposite in direction to that of the first. It meant, however, that since the first was radiating straight toward the sun from Triton's sunward side, the second mass radiate straight away from the sun from Triton's dark side, which would make the second ray point out into the void toward the constellation in which it would be in reference to the sun. That is, we calculated that by the time all would be ready for us to send the force-ray in toward the sun, the constellation Sagittarius would be straight out from Neptune and the sun; then the second ray would need to be sent out toward Sagittarius. For it would be, then, against one of the great stars of Sagittarius that this second opposing force-ray would strike, to brace Triton against the other ray striking the sun, the star calculated best for that purpose being the bright star in the quadrilateral of Sagittarius. It was apparent, therefore, that when the great force-ray was shot toward the sun, the second or bracing ray should be shot out against that bright star in Sagittarius to brace Triton against the first ray's push.

"**YET** in reality the problem was not as simple as that. For that star in Sagittarius, we well knew, lay like all the stars infinitely farther from us than the sun. It would require but a little more than four hours for the first great force-ray, which travels as you know almost as fast as light itself, to reach the sun. But it would require a number of years for the second great force-ray, traveling at the same speed, to reach the bright star in Sagittarius and strike against it. For even the nearest of the stars, of course, lies so far from our solar system, our universe, that it requires years for light to cross that colossal distance; in consequence it would require as long or longer for the second force-ray to cross such a great distance, traveling as it would at a speed almost that of light. Thus, since that bright star in Sagittarius that had been fixed upon lay dozens of light-years from our solar system, it would require dozens of years for that second great force-ray to reach that star!

"It was evident, therefore, that the second force-ray would need to be shot out toward that star long before the first, since it was vitally necessary that the two rays strike their objects at the same moment.

"The first thing to do, therefore, was to prepare the great generators and send that second ray out toward Sagittarius. That work was begun at once, for only a short time was left us. On Triton's dark side, beneath the great roof, countless great generators were constructed, giant generators of the force-situations which could by their massed power produce a colossal ray of unthinkable power. Then a great pit or giant well was sunk in the roof, one whose sides sunk down from the roof toward the surface of Triton. At the bottom of that great pit, on Triton's surface, was set the mighty mechanism or ray-concentrator that would send the gath-ered power of all the massed generators driving out into the great void in one colossal ray. That mechanism was, of course, upon Triton's surface, and was cut off from the rest of that surface by the metal walls that rose around it to the roof, since in that way it was possible to send the great ray out from Triton's surface through an opening in the great roof, the enclosing walls or sides of the pit preventing the warm air beneath the roof from escaping outward, and keeping it air-tight as ever.

"With that much done, the controls of the colossal ray and its generators were then constructed. These controls were not single but were repeated no less than twenty times, there being a score of control-boxes for the great ray, set around the walls of the huge pit from which the ray would spring forth, and entered not from without but from within those walls, of course. A single control-box would have been enough, but our object in having a score of control boxes was clear enough. It was a matter of life or death for all the Neptunians now that those controls should function properly. If this great second force-ray ceased but for a moment to go toward the star in Sagittarius, as mentioned, the backward pressure of the other great force-ray pressing against the sun would hurl Triton out of the solar system for all time, with all the Neptunians upon it. So these controls were not entrusted to a single control-box but were duplicated in twenty, so that if any one control-box was destroyed or harmed in any way, or even if a half-score or more were so destroyed or harmed, the great ray would continue to go forth.

"With that done, with the great generators ready, the ray-mechanism or opening ready, and the control-boxes and their intricate controls all completed, the first step was finished and there remained but to turn on the great ray, to send it forth to that bright star in Sagittarius. So on the day that had been designated, the Neptunians to whom had been entrusted the all-important watch of the twenty controls, took their places in the control-boxes. The great ray-mechanism had been so placed in Triton's dark side, of course, that it pointed directly toward that star which the ray was to strike, and so it was needed only to turn on the giant ray. And so, at last, with all the Neptunians gathered there beneath the roof around the walls of the giant pit, staring through those walls, transparent from within, we gave the word. Then, as one, the twenty controls were opened, and from the gathered throbbing generators from the great ray-mechanism at the huge pit's bottom, there drove upward and outward into the great void of space the colossal force-ray, visible only near its source as pale light, flashing out at almost the speed of light itself, on its stupendous journey across the void toward that bright star in Sagittarius that was its goal!

"There was no push against Triton, of course, when that colossal ray went forth, for there could be no push against Triton until that ray struck a solid body, struck the star that was its goal, and then it would push back against Triton. Just as if you reach forth to push yourself away from a wall, there is no push on your body until your hand reaches the wall. Not until dozens of years had passed, we knew, would that great ray strike the star in Sagittarius that was its goal, and not until then would come the back-push against Triton, the bracing back-push that was its purpose. And in those dozens of years, with the great ray shot ceaselessly forth to that star, of course, Neptune and Triton themselves would be moving somewhat, would be moving as Neptune followed its slow orbit around the sun. But so slow and so vast is Neptune's orbit-movement, that it would have moved but little, and as it moved, the ray-mechanism would be turned constantly a very little so that its great ray would still be directed ceaselessly toward the star in Sagittarius, and so that when that ray struck that star, Neptune and Triton would be just between or in line with the sun and that distant star.

"This half of our great task was finished, and there remained but to complete the other half, to make ready for the sending forth of the other great force-ray, the first one as we called it, toward the sun. In the years that followed, while the great force-ray traveled ceaselessly, on and on through the great void, toward that distant star that was its goal, we Neptunians were busy here upon Triton with the making ready of the newer force-ray. On Triton's outward side, directly opposite to the other force-ray's source, we constructed again the great generators that would be used for this newer ray, massing them there beneath the great roof. With those generators finished, we began again to construct a great pit or well in the roof, and to place at its bottom the ray-mechanism that would send this newer force-ray in through the solar system toward the sun.

"Terrible years were those for us, though now at last this terrible time approaches its end. For in those years we had not only to keep on the immense task of constructing generators and mechanisms for the newer force-ray, and to keep operating the other great generators and mechanisms that were sending forth ceaselessly the great force-ray toward Sagittarius; we had also to fight against the ever-encroaching cold that was densening ever its dread menace over us, and that seemed on the point of overcoming us even as we reached the climax of our giant fight against doom. For ever that cold on Triton grew greater as it grew still cooler at its heart, and ever we must make greater and greater efforts to keep operating the insensurable heat-mechanisms that alone held death back from us. Yet we spurred ourselves onward by the thought that now at last we were approaching victory over this dread menace of cold that had beset us for so long, for at last the dozens of years required were drawing to an end and the great force-ray was fast nearing the star in Sagittarius that was its goal.

"SO we labored on with all our strength, and soon the mechanisms of the new giant force-ray were finished, its great pit ready in Triton's outward side, and the twenty control-boxes set in that pit's walls. Now at last was approaching the crucial moment of our great plan, that moment in which all must be calculated and performed with infinite care lest we meet disaster. The greatest of our scientists had many times, in those years, calculated the exact moment when the huge force-ray we had shot forth would meet at last the star in Sagittarius, would strike against that star. It was necessary that the other giant force-ray that we were to send forth against the sun would strike the sun's edge at the same moment exactly as the other ray struck that star, and with the same power exactly. So all was anxiety unutterable as we approached this great climax of our plan.

"By this time, scores of your earth-days ago, Neptune in following its orbit had moved so that it was almost exactly between the sun and that distant star in Sagittarius toward which the ray was shooting. The fact that Triton revolved about Neptune did not impede that ray, of course, since as you know Triton moves about Neptune in an orbit slanted greatly, inclined greatly from the ecliptic, and so even when on the outer side of Neptune its ray would be able to go straight toward the sun, through the upper limits of Neptune's atmosphere, and so in the same way, even when it was on the outward

oid of Neptune, its great ray, that we had sent forth years before, could shoot directly toward the star in Sagittarius. The only thing awful was that the ray we sent forth toward the sun be of the same power and strike it exactly when the other ray struck that distant star, so that they would push back against Triton with the same force at the same time.

"So in tense anxiety we remained and at last there came the moment for which we waited, more than four hours before the time when we calculated the other ray would strike the star in Sagittarius. And when that moment came the signal was given and the new mighty force-ray was shot forth, from Triton's upward side, shot forth toward that edge of the sun turning away from us! That ray, of course, had no planets directly between it and the sun, we having chosen long before a time for the whole plan when this would not happen. But in the four hours and more that followed, we millions of Neptunians waited here on Triton with suspense unmitigated. The moment was approaching when this giant force-ray would strike the sun. If we had calculated wrongly, if the other giant ray did not strike that star in Sagittarius at the same moment, Triton would be hurled out to doom in the great void by the sun-ray's pressure! Tensely we waited and then at last there came the moment for which we had waited. That moment came, and passed—that moment in which the new giant ray struck the sun—yet Triton did not move beneath its pressure.

"We knew that we had won! For the other ray had struck the star in Sagittarius at the same moment, balancing Triton against the pressure of the sun-ray, and now as we observed the sun, we saw by our instruments that it was turning faster already! Its huge mass was spinning faster as our great ray stabbed from Triton to press against that mass' edge with colossal force! Within the first earth day the pressure of that great ray against the sun's edge had increased the sun's speed of spin at almost the exact amount we had calculated, had decreased its rotary period by four hours. And each day thereafter the steady pressure of that colossal force-ray has turned the sun ever faster at the same steady rate, has decreased its rotary period by four earth-hours more. So that even as we had calculated, we saw, within 150 earth-days from the first sending forth of the sun-ray, that the sun would be spinning so fast beneath that ray's pressure, its rotary period decreased to the critical period of one hour, that it would no longer be able to hold together and would divide into a double star!

"And even now that great plan which we the Neptunians, and we, the Council of Thirty, carried out, comes at last to its fruition! For already more than one-half of that time, more than eighty days, have passed, and there remain hardly more than three-score days before the great sun-cataclysm comes. Hardly more than three-score days from now the end, for all your inner planets, for all the planets save Neptune, will come, the sun reaching that critical rotary period of one hour and spinning then so fast, beneath the pressure of our great ray, that it cannot longer hold together, will divide into two stars that will whirl apart from each other and engulf in their fires all the planets save our own outermost one, sending them with all their peoples to fiery doom! For in that doom we Neptunians are sending them to save ourselves from a doom, in another way, equally as terrible.

CHAPTER XI

Desperate Chances

AS the great globe's voice ceased for a moment, that strange, stark voice to which for many minutes Marlin and I had listened, I found my brain whirling with the things we had just heard. For a moment I glanced around as though to assure myself of the reality of what was about me, of what had just been told us. The great globe, the thirty silent Neptunians of the Council around it, the other disk-headed Neptunians who guarded us—these, with the towering black walls and strange twilight about us, only deepened the strange sense of horror in which I had listened. And now the great globe was speaking again.

"Thus it is clear to you how unalterable is the doom that we are laying upon the sun's other planets, upon your own planet, to save our own. Nothing now can save your world, and the other worlds of the sun, from annihilation, and it is to make that clear to you that we of the Council have told you this much of what we have done. Nothing can save your world from death, yet you two of that world shall escape that death with us Neptunians. For it is evident that your race and you must have considerable scientific knowledge to enable you to imitate our great force-ray and use it to venture out here to Neptune. So that, though lesser than our own great ancient race in science and knowledge, it may well be that you have certain knowledge, which would be new and useful to us. For that reason you have been saved, and have been taught our Neptunian tongue. From now on our scientists will question you, and whatever of new knowledge you are able to give to us, you shall give. You have heard, from us, how hopeless it is to think more of your own doomed world, and you know, of course, how entirely in our power you are. Therefore think well, when you are taken back to your cell, upon what you have learned here, since it is only for the sake of what little our knowledge might gain from you that you two have been preserved from the death.

The great globe was silent, and before we could reply to it, could gather even our whirling thoughts, the Neptunians guarding us had closed about us again, pointing to the door through which we had come. As in a flash Marlin and I were led through that door, the great globe turning and following us with its single vision eye as we went out. I think that neither Marlin nor I came to complete realization of our surroundings until we had been thrust once more into our little cell. For it was only then, staring toward me as though half-unwillingly, that Marlin repeated slowly the great globe-ambassador's last words.

"The death that in days will overtake our world! And the Neptunians are leading that death on our world and all the sun's other worlds to save their own races!"

"And that is the explanation of all!" I exclaimed.

"The great ray that turns the sun faster, the other ray shooting out toward the stars, the dead and deserted surface of Neptune, the crowded surface of Triton—God, Marlin, if we could only get back to earth with what we know!"

"We must get back!" he cried. "Even if we escaped, we two could not turn off that great sun-ray, could not wreck all its twenty controls. But if we could only get back to earth and lead back here the dust of space-fires

"I hung with head and body downward into the cell . . . and as Martin shot across the cell . . . I reached to grasp him.



that the World President planned to build?"

"It's hopeless, Martin," I said. "We've thought of a thousand ways of escape in the days that we've been here, and not one has even the wildest chance of success."

Hopeless indeed it seemed to Martin and me as we sat there silent in the dusky little cell. For the colored epic of Neptune's past and mystery which we had heard there from the Council of Thirty, from their glubs - mechanisms that centralized their minds, had impressed in us a profound despair. We had found at last the explanation of all this vast enigmatic thing that was wrecking our universe, but had found in that very explanation new depths of hopelessness. Earth was doomed, the solar system as such was doomed! We gave it, now, beyond all doubt, we, who alone of earth's races knew whence that doom was coming. And I think that neither Martin nor I, sitting silent there in the dusk of our cell, gave any thought to the terrible fate that hung over us two who had been kept alive, as we may know, for whatever possible knowledge we might be able to impart to the Neptunians. We forgot our own fate of a living death amid the Neptunians in our agonized contemplation of the great deepening shadow of doom that was darkening the sun and all its universe.

It seemed to us, as we sat there, that it was centuries, rather than weeks, since Martin had given to earth his first warning of that doom, his first spew of the sun's increased spin. All that we had come through since that time seemed the events of countless years. The great meeting of the World-Congress, and its adoption of the plan of Martin and Whately; the building of the space-flier and that start by night of Martin and Randall and Whately and myself in it; our starting flight out from earth on our great mission, past Mars and through the dangers of the asteroid belt, past mighty Juniper and on, swimming through the perils that almost annihilated us at Saturn, to our goal, Neptune; our amazement at finding that world warped and crushed, the venture of Martin

and myself down into its dead and deserted compartment-city; the attack of the Neptunians, the pursuit and destruction, somewhere out in the mists of Neptune, of our two friends, of Whately and Randall in the space-flier; and our own capture, our own journey to Triton's swirling, strange world, and our days' imprisonment; and now, at last, this tragic tale of the past and purpose of Neptune's doom, which had been told us by the great gale of the Council. It seemed incredible, indeed, that all of these things could have been so compressed into the time of a few-score days as they had been.

Yet they had been, I knew, and knew too that the sixty-odd days that remained to us before the end came, before the sun, spinning ever faster beneath the pressure

of the giant ray from Triton, split at last into a double star, that these three-score days would span centuries on centuries of agonizing torment for us two, who must wall, imprisoned here, for the doom that was closing down upon the solar system to come to its dread climax. And at that thought, at the thought of that helpless inaction that must be ours, a blind unresembling revolt arose in me as in Martha, and like him I sprang to my feet, paced the little cell's length with clenched hands. All was unchanged about us, the towering black walls around us, the half-beard staccato voices of the Neptunian guards outside, the dim roar of sound that came to us through the twilight from Triton's swarming seaward side. The very changelessness of the things about us pressed upon my spirits with such suffocating force in that moment, that I was almost on the point of beating blindly against the cell's door, when recalled to myself by the suddenly tense tones of Martin's voice, beside me.

"Hunt!" he exclaimed. "There is a chance to get out, I think! I've been thinking, and if we can make a great enough effort I think that we can woe clear of this cell, at least."

I shook my head. "It's no use, Martin," I said. "We've gone over it all a thousand times—there's no way out but through the door, and that never opens but with a half-dozen Neptunian guards standing with ray-bats outside it."

"But there is another way," he persisted. "Out the cell's top, Hunt, out the roofless top!"

"We tried it," I told him, "and it was useless. Even with the lesser gravitation here on Triton, even without these weights on our feet, we could only jump a score or more feet straight upward, and the walls are two hundred feet high and utterly smooth and vertical."

"But one way we didn't try," he insisted, and as I listened with dull lack of interest, he went on to outline to me his idea. And as I listened, my indifference suddenly vanished, for I saw that Martin's keen, inventive brain had really found a plan that would give us a chance of escape. "It's our one hope," he faltered, "and if we can use it to get out of this cell, we'll have a chance to stow out of those cylinders of the Neptunians and get back to earth in it in time!"

"We'll try it at once, then," I said, excited now at this faint gleam of hope. "For the charging-hour for the Neptunians on the dark and seaward sides comes soon, and we don't know how soon these Neptunian scoundrels, who are to question us, will be coming here."

WE prepared for the attempt at once. Our first and main preparation was to unbind once more from our feet the little and great-weighted disks of metal, which increased our weight against Triton's lesser gravitation to its normal earth figure. With these disks removed, our lightest step sent us a few feet into the air, so greatly were the results of our muscular efforts increased. Then, since with my somewhat greater strength I was to be the first to try Martin's plan, I stepped, or rather leaped, toward the compartment-cell's side with a single step, crouching down there with my body braced against the wall behind me. From that position the square little opening of the cell, two hundred feet above, seemed infinitely distant, yet I did not despair, drawing a long breath and then with all the force of my muscles leaping obliquely upward. Upward

and slantwise thus I went with the force of that leap for more than a score of feet, toward the opposite wall that much higher from the floor, seeming to float smoothly up—so much slower than on earth was my progress through the air.

And as I shot smoothly toward the opposite wall I was twisting myself in mid-air, so that when I struck that wall, more than a score of feet above the floor, it was my feet that struck it. And as they struck it, bent with my impact against the wall, I slumped straightened them again, shot suddenly away from that wall again on an upward slant again toward the other wall. Again, as I floated upward, I was twisting in mid-air to strike that wall feet-foremost, and again as I struck it I was kicking against it with my legs, so that hardly had I touched it than I was shooting back across the cell again toward the opposite wall, but again on an upward slant, gaining a score of feet on each strange leap I made thus across the cell! Thus, in zig-zag leaps from wall to wall, I was progressing up the narrow cell toward its roofless top far above! It was just the same as when on earth a man in a wide chimney can work himself up from bottom to top of it by leaning himself now against one wall and now against another. And the fact that the cell was much wider, could only be touched one wall at a time, was counterbalanced by the fact of Triton's far lesser gravitational power, which alone was making it possible for me to continue my strange progress upward!

On Triton alone, indeed, or on an world of similar size and gravitational power, was such a feat possible, for only thus could one leap with such new impetus each time from wall to wall, and twist in mid-air to strike head-on for another leap. And as I kept up in that criss-cross fashion from wall to wall, my heart beating rapidly, putting all my strength into each great leap, I could see Martin on the cell's floor below gaining up tensely through the dusk, knew what depended upon our escape, and so struggled upward with a superhuman strength. Up—up—back and across—across and back—in leap after slanting leap upward I progressed, until with a half-dozen more leaps the cell's open top lay close above me. By then, though, the energy which I had summoned for this superhuman feat seemed fast waning, and as I shot from wall to wall I realized that I was gaining less and less toward the top with each leap!

Another leap—another—and as I shot back across the cell's width from wall to wall I was aware of the wall's top but a few yards above me, yet felt at the same time the exhaustion that had gained upon me, new almost near to overcoming me. Another leap—with agonized muscles I propelled myself back to the opposite wall, with the top of that wall but a few feet above me. One more up-slanting leap would take me back up and across to the opposite wall's top, I knew, but in that tortured moment I felt that I could never make it, and knew that if I missed it I must inevitably fall downward. So, as I struck that wall feet-foremost, I put the last of my strength into a great effort and shot frantically across the cell's width for the last time. And this time, with hands outstretched, I struck the top edge of that opposite wall, fumbled with it for an agonizing moment, and then had grasped it and had drawn myself up on the thick wall's top!

For a moment I lay across its top, oblivious to all else in the exhaustion that possessed me, inhaling and exhaling great panting breaths. Then as I drew myself

up a little I peered about me. Far away on all sides of me stretched the walls of the compartment-city that covered all of Triton, those wall's tops intersecting like a great checkerboard, and all level with the thick wall's top on which I lay. Twilight lay over a broad band of that compartment-city about me, the twilight band between the dark and sunward sides, the brightest day of the sunward side stretching away to one side, humming with activity and with many cylinders moving to and fro above it, while to the other side stretched the silent, sleeping dark side, beneath its unchanging night. Now I gazed down through the dusk toward the cell's floor far beneath, and saw Merlin going up toward me anxiously, gestured silently to him. And in a moment more he was coming up toward me by the same great zig-zag leaps from wall to wall that I had used.

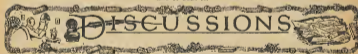
In anxious suspense I watched him as he came gradually up toward me, shooting from side to side of the cell in upward-slanting leaps that brought him each many feet upward. Gradually, though, I saw that the force of his leaps was lessening, his upward progress slowing, as he, too, began to feel the waning of his strength. I knew that, older than myself as he was, those leaps were tiring against Merlin even more than they had done against me, and in utmost suspense I watched as he came more and more slowly toward me. At last he was but a score or more feet beneath, his face tense and strained as he shot from wall to wall, gaining now but a few feet each leap. With clenched fingers I watched him, powerless to help, saw him by a last gathering of his strength making another up-slanting leap and another and another, until but one more was needed to reach up to the wall on which I crouched. And even as Merlin made that last leap, even as he shot across the cell's width and up toward the wall on which I crouched, I realized with a thrill of horror that he had leaped short!

In that moment, as Merlin shot across the cell's width toward me with hands outstretched, I saw his white, strained face and knew that even as I did he realized

the shortness of the leap that he had made with his last strength, realized that his outstretched hands would miss the wall's top by feet. That moment in which he shot across the cell, as his own hands struck the smooth wall of length, yet as he shot toward me it was more by instinct than by conscious thought that I acted. Swiftly hooking my knees over the wall's top upon which I crouched, I hung with head and body downward into the cell, reached downward with hands open, and as Merlin shot across the cell, as his own hands struck the smooth wall of it many feet below the top, I reached and grasped them tightly. A moment thus we hung there, he held by my own down-swinging body, and then holding his own head by one of mine I reached upward with the other, drew myself slowly and with an infinite effort upward. In another moment I had drawn myself and Merlin on to the wall's top, and there crouched with him again in a stance of exhaustion for the moment. Only his and my own lessened weight, on Triton, had made it possible for me thus to save him.

For but a moment we crouched there, then raised ourselves and looked quickly around us. Cylinders were moving to and fro from time to time over the compartments of the twilight band, from the sunward side, and we knew that if we remained upon the wall's top long we would inevitably be discovered. We must descend into one of the compartments as swiftly as possible. But into which one? In an endeavor to solve the question, we began to crawl quickly along the top of the wall, going down upon its other side as we did so. The compartment on that other side was a cell like our own, and it was empty; but its only egress was into the hall between the cell-rows, and that was guarded by the Neptunian armed guards. To descend into it or into any of the other compartment-cells was useless, so along the wall's top we crawled, through the dusk, until in a moment or so more we found ourselves holding down into one of the irregular-shaped anti-rooms to the great circular compartment of the Council of Thirty.

END OF PART II.



In this department we shall discuss every month topics of interest to readers. The editor invites correspondents on all subjects directly or indirectly related to the science appearing in this magazine. In case a special personal answer is required, a suitable one of this or some time and postage is required.

THE SCIENCE CORRESPONDENCE CLUB

The club which makes of your magazine here has been playing about a new feature thing. We would be glad to have our members, those interested in science information from either of the following:

Walter Denton,
463 Ashland St.,
Chicago, Ill.
Edmund Palmer,
3411 35th Street,
Minneapolis, Wis.

I have with you the Friends of the COMBINATION OF THE SCIENCE CORRESPONDENCE CLUB.

We, the members of this organization, in order to promote the advancement of Science in general, invite the layman of the world through the use of Scientific and practical and exclusive of any one, to advise and establish the conditions for the Science Correspondence Club.

F. A. H. Matthews,
2345 34 Ave., O-Street, D.C.

(We are glad to publish the correspondence about the club. Let all such contain the members see the magazine, and arrange to receive yours to help the good work.—Editor.)

THE SPEED OF LIGHT AND OF SOUND

I am an amateur reader of Amateur Science and quite then very weak. The way you write I am awfully like to you. The answer is I would like to find out something and I think that you could give me the necessary information. What I would like to know is the known on the speed of light and sound and how these are tested.

If you can't do me this information, could you tell me where I could get a book dealing with these subjects and astronomy?

I would be very much obliged to you if you could forward this information, and it would serve a double purpose to my friends and myself.

Henrietta Rabinowitz,
232 Pleasant Ave., New York City.
(The velocity of sound is determined in inches)

Let a candle be fixed at a point distant a known space from the observer. As it is fired, a flow of light is produced visible to the observer, who, with a theodolite apparatus, observes the time between the flash and the sound of the explosion. As light practically moves an infinitely short time to go over any terrestrial distance, the time between flash and the sound of the flash. For light one mile takes but about 1/180,000 of a second, so is referred to number distant error, which reflects it back to the first source and then back to the observer. This time comes at an astronomical distance, but in order to avoid difficulty, so that, when the waves travel from the distant source, the angles of incidence and reflection are not quite what they were before, and so the waves are not reflected directly back to the old source, but are deflected slightly. If the amount of the deflection, the distance apart of the two mirrors, and the rate of vibration of the rotating mirror are known, the velocity of the error can be calculated. The spectrographs and laser or plasma give other methods.—(Editor.)

(Continued on page 311)

In the Realm of Books

MOSTLY SCIENTIFIC FICTION

Shades of the Way Man

"The Gladiator" by Philip Wylie. Published by Alfred A. Knopf, New York, 1929, 320 pp.

"THE GLADIATOR" is a book which starts well, is quite readable and interesting throughout, but is, after all, disappointing. It is based on the fact that man, such as ants and grasshoppers, are veritable giants of strength, comparing their size to that of man. The father of the hero, one Alphonse Darnay, a bio-chemist, succeeds in isolating and making a strength-producing toxin, and succeeds in producing tobacco capable of doubling the size of the aspirator and in producing a super-ox, which, at the age of seven weeks, opens doors by twisting them to splinters, lifts his mother by a playful parakeet and later on kills full-grown men.

It seems that the secret, or whatever you call it, originates only through the mother, and succeeds in producing a brown being with prodigious strength. Alphonse inoculates his wife. The experiment is a success. The child, a boy, is a marvel. At the age of one week he is able to lift himself back to a chair by the use of one hand. His father and mother start a campaign of repression and the child, Hugo by name, as he gets older, is usually afraid of using his gift of super-human strength. As he grows up, his indomitable complex grows with him. True enough he has never given plenty of blows, but not enough time to appreciate what blows he has, a hardy, a prodigious strength-producing strength. His tragedy begins on returning. He quits college because he accidentally kills a boy during a football game. He goes sailing, across the lives of several people, to show, as it were, for the accidental murder, does some deep sea diving, finds a lot of pearls (he opens the oyster right on the spot, since he can stay under water longer than anybody else), and lands in Mercator's net as the World War is declared. He naturally helps to "make the world safe for democracy" and proceeds to clean up the German Army single-handed. He is unmerciful. Sharp bayonets put glances all his skin, nor can anybody get within five feet, only leaving red spots. He starts to jump forty feet and to run with the speed of an express train, provides his trench with ammunition, food and drink, all of which he loads in bundles weighing over two tons. His pal "Shayne" is blown to bits by a German shell, which inflicts him so that

he breaks a German trench and kills hundreds of men, lurching by just crawling them. It is most modestly sized (over 90) is the boy, that Hugo's mighty deed induced the Germans to give up in disgust and sign the Armistice. The father of his pal, Shayne, visits him in France and is struck with Hugo's modest tone, and is through the older Shayne's loving care, grows to a nation. With the end of the war Hugo returns to America, but his indomitable complex rises like a herd that he orders all his money to his parents and goes to work as a common laborer in a small factory. Here, as everywhere, his strength creates hatred and mistrust. He is loved to quit and lives out as a farmhand. A nice little love affair with the farmer's wife turns sour, when he kills the smoking pipe ball with a blow of his fist. A terrifying sensation him went to the bedside of his father, who, before his death, reveals to him the secret of his being, in the shape of notebooks containing his case-history. Hugo then goes to Washington, enters politics, and works the house of an obstreperous lobbyist. But even he is not strong enough to close out the August stable of corrupt politics, and goes to New York. There he starts to work as a clerk in a bank. His strength is again his undoing, because by saving the life of a fellow-worker, he turns thereby, in the eyes of the bank president, becomes a menace to all banks. He is arrested and "third degree" by the police. What he does to millions of the law is enough. He then organizes an explorer to Yontar, saves the life of the man by holding, lifting and throwing a block of some weight many tons and is finally released by the explorer to reveal the secret of his strength. The explorer, a student of high degree, wastes empirical and outlines to Hugo the possibility of creating a large number of super-men, such as he, based on his father's experiments, in order to rid the world of enemies. It goes wrong, all into the jungle and is utterly destroyed, not only and all, by a stroke of lightning, which is a rather odd fate, just as he had found someone who had completely understood him and had found for him a place in the scheme of things and shows him where and how to be useful, he dies.

In spite of the obvious shortcomings of this book, it is quite readable and will not be forgotten so easily as the average "best seller."—C. A. BRANDT.

The World Below

"The World Below," by S. Fowler Wright. Published by Longmans, Green & Co., New York, 1929, 320 pp.

THE first part of this book was published under the title "The Amphibians" by the Minton Press of London in 1923, and the present volume is virtually a reprint of the earlier edition with the addition of a second part consisting of 16 chapters. In his previous books "The Deities" and "Divers," Mr. Wright gave us his version of how modern man would react if another thing should happen. In his book "The Island of Chozas Sparrow" he has pictured the adventures of a modern couple among people evolved to avengery, and has shown the possibility of a splendid imagination, but unfortunately has the same tendency toward wordiness as his countryman Herbert George Wells has. Furthermore, where Wells is clear and plain to satisfactory explanation, Wright is astruse and vague. "The World Below" presents the problem: How will modern man behave in a world totally different from the one in which he grew up? There is apparently only one way of getting into the future and that is via the fourth dimension, which has been explained considerably by scientific fiction writers, ever since Mr. Wells invented the "Time Machine."

The hero of "The World Below" is projected by Professor Dushy 500,000 years into the future. He arrives in a strange world, where time seems while they attack, where the hot air projects rubber-like roots to trap the wanderer, where skeleton frog-like monsters are peeped and eaten it is almost by aquatic human beings called the "Duslers," a world where the sea is peopled and controlled by fatty herring-like, yet scorpion-like, who telepathically communicate their thoughts to one another regardless of distance.

After very number of queer adventures, fights, escapes, etc., he is finally brought back to his own time.

This book is pleasing to a considerable extent. It is vague throughout, yet this very vagueness is not without its charm. It reminds one faintly of "Alice in Wonderland," in which countrying is impossible, yet seems quite true.

In the Amphibians which accompanied the hero on his adventures, Mr. Wright has pictured an unusual creature, whose great charm will not easily be forgotten.—C. A. BRANDT.

A MEMORIAL OF OUR AUTHORS

Editor, Amazing Stories.
Your *Amazing Stories* are absolutely wonderful, a real stimulus for the average fanatics. These stories also are undeniably better technical items and appear intelligible in the real world, should you have a better direction. The name, *Amazing Stories*, is all that is lacking.

These stories are written with educational and scientific content, suitable in themselves. The author weaves these scientific topics into his story, in a simplified and attractive style, so the layman can readily grasp it. The reader does not draw their readers to examine everything in their stories to be proved false. The reader, being an old-fashioned man, should be satisfied with the scientific facts that he can understand in his own mind. The author should be satisfied with the facts, accepting the former and rejecting the latter, although the latter being at the forefront, it should be accepted in the future.

Quite a few of the present discoveries and inventions were looked upon as absurd and impossible, but let us remember we are in the twentieth century of wonderful accomplishments and inventions. We are passing by inventions into the realm of the marvelous. The future is proposed with latest possibilities, and that one opinion are gradually accumulating from the brain of man. This will come for months upon the world of the present and will certainly discover the present future which has been responsible for its existence and life.

Charles Smith,
Tulsa, Texas County, Oklahoma

(This letter is of a type which most magazines seem to be barred against. It is written in the most concise manner possible, and is not intended to be published.) The present correspondence seems the right way, and expresses the idea underlying *Amazing Stories* better. It is much less than done in the past that reader training classes were to be looked for in the future.—Kerrick)

A LETTER FROM CAPTAIN MARK ABOUT "THE RED DEER"

Editor, Amazing Stories

If you can spare me a little more in your "Inventor's column," I will endeavor to answer some of the objections that in the present world in "The Red Deer" that the existence of a gravity force would extend the atmosphere of the earth. To begin with, I cannot prove my point. Once an author leaves the realm of present scientific knowledge, which is acceptable of most, and ranges out into the field of speculative theories, the best that can be done is to show that the laws of science knowledge are extended.

The objections seem to fall into three general groups, each of which I will discuss in turn.

Objection 1. If a greater mass were placed on the earth, gravity emanating from all source points at the earth's surface would soon overcome the effect of the air, and the volume in which gravity was interrupted would be a zone whose base would be the surface. Answer: Gravity was supposed to be a wave motion of pure wavelength. Such a force would not emanate from every point on the earth's surface but from one point, viz. the center of gravity of the earth. If we assume that the center of gravity lies at or near the center of mass of the earth, the rays or lines of gravity would leave the earth's surface virtually normal to that surface, and the volume in which gravity



was interrupted would be the thickness of a shell, whose area would be the entire of surface of the earth, whose base would be an area, larger but corresponding in shape to the mass at the shell base. If the mass were and whose outer surface would be the gravity surface. This is illustrated by the diagram above.

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which we measure by the name of "time" is inherent in all sciences abstract or concrete. Otherwise they "would not exist" as such.

The part of the story that has to do with the "other-worldly" signs of "The Great Dictator of the Cosmos" is as strictly scientific as "physics" or the others of pure mathematics and modern physics. As far as I know your reader, it should be published as widely as possible. I try to remark all here to Dr. Bremer for his or her to working it.

The last three members of American Science set on high a mark you will have to "give time" to know it. "Give us your best advice."

One correspondent objects to the "signs" as an illustration to "break them the Rules." I have seen many, and know how they can be, though there I also were available. A speech will be soon made.

I see nothing a lack of eloquence here "Dinner" again. The young correspondents as a rule show good logic.

Leo Davidson,
Box 24, Corvallis, Maine

THE GOSTAK AND THE DODDER

Editor, Amazing Stories:
I have read the "old English" American Science for the past year, but this is my "first" letter to the "editors." The magazine has been "good" and given plenty of fun in those few years. I have seen occasionally taught me to do things, as it will report many others. I am sure, I have been hit "on the nose" since I read "The Great Dictator of the Cosmos" by Mr. Edwin J. Bremer, M.D. This story is like a man riding a comet, etc. A story without a meaning. I am sure as it all don't I might add the story. "The Ship that Turned Inside" by Dr. Taylor Watson was a bit "dumb," but Mr. Wendenbush certainly "filled in" with a message and something that made it quite interesting and although I have not read of the "South American" - - - - - I just that Mr. Wendenbush would do us justice by finding a way for this to the strange people on the beach by the side. You know a straight girl is slow and to make a "teacher" to go through to get back to that discipline you find the message by looking for the "right" way, sorry the poor American get it, or say the letter and passages. Besides they all need "previous" reading.

"The Green Girl" is fine but far from the "best" "Children at War" also is good. The "Excursions" are impressive really. Cover design is also in perfect harmony with the contents and hard to improve. Grade of paper used is nice on the whole as all I can say is that Dr. Bremer's sort "efforts" toward science will be of a service, but his "Great Dictator of the Cosmos" was like "dinner" a point. I also don't think he will pardon my criticism, but I just say "bravo" to body that I had to make an effort to "digest" his. But I am looking forward to the next issue.

W. E. Cronshaw U. S. N.,
Dundeeville, Oklahoma

P.S.—I shall consider it very personal soon you to make some "improvements" regarding "The Great Dictator of the Cosmos," "The Green Girl" and the "Dobber" and why and wherefore of "Gothicism" one or the other? (Mr. Wendenbush, later all help you with your definition about Dr. Bremer's scientific bit of science and romance—Bremer.)

THE GOSTAK AND THE DODDER—

Editor, Amazing Stories:
In reading the March issue, I came across your address about the subscription, but before it which drew me to you. I am sure, I don't think much of a letter who wouldn't try but since it is better, but would like to read that letter, and I am going to let you if you will please do please? You see, I have of was accused your mistake and almost proved it and I would like to see just what other persons who read "The Green Girl" to truth, really said. Can't you step out of the routine just for once and publish it?

You may not like the next statement, but I'm going to say it. Of all the stories you have printed, I don't think I can remember that of those of them. You see they are unimportant, and I know these or such, but there is just what I have thought of being already said that is "The Vision of Venus".

That is told in such a convincing way that I almost believed, and I probably would not believe down that do you ever have for this tale. Now about "The Green Girl" by A. Merritt. I read the passage of it in "Discussions" and was very because I didn't read it, but when I saw it in a public library I began into it and was the good as a result. I appreciate and strongly

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